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WORK PLAN

**FIELD SAMPLING PLAN
RCRA ENVIRONMENTAL
INDICATOR FOR CURRENT
HUMAN EXPOSURE (CA-725)**

**W.G.KRUMMRICH PLANT
SAUGET, IL**

Prepared for
W.G. Krummrich Plant
520 Monsanto Avenue
Sauget, Illinois 62206



November 2002



URS Corporation
2318 Millpark Drive
Maryland Heights, MO 63043
(314) 429-0100
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SECTION ONE

Project Background

1.1 INTRODUCTION

Solutia Inc. (Solutia) is undertaking a surface and subsurface soil sampling program at its W.G. Krummrich Plant in Sauget, Illinois to facilitate the completion of the Resource Conservation and Recovery Act (RCRA) Current Human Exposure Environmental Indicators (EI) Report (CA-725).

A Site Sampling Plan (SSP) was previously developed and included in the "Description of Current Conditions Report" (DOCC) dated August 1, 2000 (Solutia, 2000). The DOCC report was prepared in accordance with Section VI of the Administrative Order on Consent (EPA Docket R8H-5-00-003, dated May 26, 2000) (Order). The SSP addresses the collection of surface water, groundwater, and soil samples. This Field Sampling Plan (FSP) has been prepared to facilitate the soil sampling objective of the SSP. To accomplish this objective, and in accordance with the Order, a Field Sampling Plan, Quality Assurance Project Plan (QAPP), and Health and Safety Plan (HASP) have been prepared. The main components of the SSP addressed in this FSP include:

- Surface soil sampling
- Subsurface soil sampling

Background information with respect to the Krummrich Plant is provided in the DOCC Report.

SECTION TWO

Project Scope and Objectives

The purpose of the FSP is to describe soil surface and subsurface sampling to be carried out at the Krummrich Plant to gather enough data for the completion of the EI Report for current human exposures. The facility location is shown in **Figure 1**. Collected data will be used to prepare a Human Health Risk Assessment (HHRA) to help support the EI report conclusions.

In November 2002, Solutia transmitted to USEPA a draft Conceptual Site Model (CSM) for the site. The CSM was developed to support the EI evaluation for human exposures and identifies the potentially complete exposure pathways and the sources and mechanisms by which human receptors may be exposed. Thus, it helps define data needs for completion of the EI evaluation. A copy of this draft CSM is included in **Appendix A**. At the time of submission of this FSP, comments on the draft model had just been received from USEPA. Those comments have been reviewed and, at least on a preliminary basis, do not appear to affect the scope of work described in this document. Responses to those comments are being prepared and a revised CSM will be submitted to USEPA.

The draft CSM concluded that additional data are needed to evaluate the soil and air pathways. This FSP describes the scope of work to gather the necessary soil data. A separate FSP will be submitted describing the investigations necessary to evaluate potential current human health risks posed by the air pathway.

It is estimated that the field investigation, laboratory analysis, data interpretation and the report preparation will take approximately 4 to 5 months from the work plan approval.

SECTION THREE

Field Activities

3.1 SOIL SAMPLES

This program has been designed as a grid-based effort and is not intended to address each Solid Waste Management Unit (SWMU) or Area of Concern (AOC) on an individual basis. The basic sampling scheme consists of a 300 ft by 300 ft grid overlain on the areas of the plant where surface and subsurface environmental impacts are known or suspected to have occurred (**Figure 2**). This includes the areas currently and historically used for manufacturing (DOCC report). One soil boring is proposed for each grid square for a total of 61 boring locations. The actual locations will be determined in the field and will be biased based on site features and previously identified areas such as SWMUs or AOCs, or questionable areas identified from aerial photographs. Thus, in addition to the grid locations shown on **Figure 2**, an allowance of 5 additional sampling locations have been included in the investigation plan to cover these questionable areas.

Rationale

The sampling rationale is based on the CSM. The primary receptors are site workers who might come in contact with affected soils. The maximum depth of utilities at the plant that could require maintenance is 15 ft. However, routine maintenance activities will not occur below the groundwater table and, consequently, it is not necessary to sample below the water table. Thus, soil borings will extend to the groundwater table, or to a depth of approximately 15 ft at the locations shown in **Figure 2**, whichever occurs first.

The analytical suite includes combinations of VOCs, SVOCs, pesticides, herbicides, PCBs, dioxins and metals. Many samples will be analyzed for all the analyte groups. However, the following procedure is proposed to focus the extent of testing.

- All collected samples will be analyzed for VOCs and SVOCs. In addition, samples collected from the facility (not including the River Terminal and the pipeline route) will also be analyzed for PCBs. These analyte groups include those analytes most prevalent in manufacturing processes at the facility as well as those most frequently detected in previous investigations at the facility (see DOCC report).

SECTION THREE

Field Activities

- All the shallow samples will be analyzed for metals with the exception of samples collected from the River Terminal or the pipeline route¹. The deeper samples will be collected and retained at the laboratory until shallow preliminary results are available. The preliminary metals results will be compared with Data Quality Levels (DQLs) identified in the QAPP. If the DQL values are exceeded in the shallow samples, then the deeper samples will be tested.
- Samples for dioxin analysis will be focused in areas where relatively high levels of PCBs are present and/or areas associated with production of chlorophenols. Sampling and analysis associated with RCRA closures indicated a direct relationship between these constituents (Solutia, 1998). Samples will be collected for dioxin analysis, submitted to the laboratory, and extracted. If the preliminary PCB results in any sample exceed the DQL level (1 mg/kg) or any preliminary chlorophenol result (tested as SVOCs) exceed the DQL levels (2,4,5-trichlorophenol 200,000 mg/kg, 2,4,6-trichlorophenol 390 mg/kg and 2,4-dichlorophenol 610 mg/kg), then that sample extract will be analyzed for dioxins.
- The primary pesticide produced at the facility is paradichlorobenzene (e.g., ingredient in moth balls). This analyte is reported as an SVOC. Chlorinated pesticides and herbicides were not produced at the plant as currently configured. Herbicides were historically produced by Monsanto in areas now occupied by Ethyl Corp. (e.g., north of the facility). However, Solutia proposes to analyze samples for pesticides and herbicides on a 600-ft grid spacing (i.e., every other location shown on **Figure 2**).

Table 1 presents the analytical methods to be used during the investigation. A detailed sample summary for the soil sampling is presented in **Table 2**.

Field Procedures

The borings will be advanced using direct-push techniques (e.g., Geoprobe®). They will be continuously sampled, logged based on recovered samples, and screened with a photoionization detector (PID). Two samples will be collected from each boring. One sample will be obtained from the 0 to 2 ft bgs interval and will be indicative of surface and near-surface exposures. The second sample will be collected from an interval between the surface and total depth that is judged to be most impacted based on field observations. Borings will not be terminated in material that is judged to be highly impacted (i.e., waste material). If these types of materials are

¹ Constituents of potential concern for the River Terminal and pipeline route include VOCs and SVOCs.

SECTION THREE

Field Activities

present at a depth of 15 ft, drilling and sampling will continue until this material has been vertically defined (based on field observations). However, borings will not extend into the water table. Upon completion, the borings will be backfilled with granular bentonite.

Prior to initiating sampling activities, the boring locations will be marked and the locations will be reviewed with Solutia to check for buried utilities.

Appendices B and C present the standard operating procedures for soil sample collection and guidance on sample logging, respectively.

The field activities include documentation, QA/QC activities, equipment decontamination, and handling of investigation derived waste. A brief discussion of these topics is presented below.

DOCUMENTATION

URS personnel will keep a bound field notebook while performing sampling and oversight activities on-site. The field notebook will contain general information including but not limited to:

- Date, time, weather conditions, equipment, and personnel on site
- Area in which the work was performed
- Specific work activities conducted
- Photoionization detector (PID), combustible gas meter (explosimeter), and real time aerosol monitor (RAM) readings.

In addition to the general information discussed above, the field notebook will also contain specific information regarding the daily work activities. This information will include but is not limited to:

- Samples collected
- Depth of borings
- Observations of site conditions
- All changes to the Scope of Work or Health and Safety procedures.

SECTION THREE

Field Activities

The minimum documentation requirements for the field notebooks are provided in Section 6 of this FSP.

QA/QC

To verify field and laboratory procedures, quality assurance/quality control (QA/QC) samples consisting of duplicate samples, matrix spike/matrix spike duplicate (MS/MSD) samples, field blanks and trip blanks will be collected and submitted to the laboratory. The sampling procedures and frequency will follow QA/QC Standard Operating Procedures (SOPs) located in **Appendix D** of this FSP.

Analytical samples (including QA/QC samples) will be tracked using appropriate Chain-of-Custody documentation. The Chain-of-Custody procedures are described in Section 6.1.3 of this FSP.

Decontamination

In order to reduce the potential for exposure to hazardous materials and limit the possibility of cross contamination of samples, personnel and equipment will be subject to a decontamination program. All equipment used on-site that comes into contact with site soils will be decontaminated prior to beginning work, between sampling locations and/or uses, and prior to demobilizing from the site. Section 9 of this report describes proper decontamination procedures.

Investigation Derived Waste

Investigation Derived Waste (IDW) will be placed in containers such as over-pack drums or roll-off containers. The various containers will be stored within a central Solutia-designated storage area pending appropriate disposal.

SECTION FOUR

Project Organization and Responsibilities

URS Corporation (URS) will perform the field activities, validate and interpret the data, prepare the EI report, and provide project management for support sampling activities. Analytical services for the investigation described in this FSP will be provided by Severn-Trent Laboratories located in Savannah, Georgia and Sacramento, California. ENSR International will perform the Human Health Risk Assessment. The responsibilities of key project personnel are described below. The responsibilities of key laboratory personnel are described the QAPP.

4.1 PROJECT ORGANIZATION

The responsibilities of the key project personnel and the lines of authority for the project personnel are described below.

4.2 MANAGEMENT RESPONSIBILITIES

4.2.1 USEPA Region V Remedial Project Manager

The USEPA Region V Remedial Project Manager (USEPA RPM) for this study will be Ken Bardo.

4.2.2 Solutia Project Manager

Richard Williams will serve as the Solutia Project Manager. As such, he will have the overall responsibility for the project. He will be responsible for implementing the project and will have the authority to commit the resources necessary to meet project objectives and requirements. His primary function is to verify that technical, financial, and scheduling objectives are achieved successfully. He will provide the major point of contact and control for matters concerning the project. The Solutia Project Manager will:

- Define project objectives and develop a sampling plan schedule
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task
- Acquire and apply technical and financial resources as needed to verify performance within budget and schedule constraints
- Monitor and direct the field leaders
- Develop and meet ongoing project staffing requirements

SECTION FOUR

Project Organization and Responsibilities

- Review the work performed on each task to verify its quality, responsiveness, and timeliness
- Review and analyze overall task performance with respect to planned requirements and authorizations
- Approve reports before their submission to USEPA Region V
- Ultimately be responsible for the preparation and quality of reports
- Represent Solutia at meetings.

4.2.3 URS Project Officer

Robert Billman will serve as the URS Project Officer. He will be responsible for the overall administration and technical execution of the project. He will report directly to the Solutia Project Manager.

4.2.4 URS Project Manager

Jeff Adams will serve as the URS Project Manager (PM). He will have overall responsibility for verifying that the project meets the stated objectives and URS quality standards. He will report directly to the URS Project Officer and is responsible for technical quality control and project oversight.

4.3 QUALITY ASSURANCE (QA) RESPONSIBILITIES

4.3.1 URS Data Validator

John Kearns of URS will serve as the lead third party data validator. He will remain independent of direct job involvement and day-to-day operations and have direct access to corporate executive staff as necessary to resolve QA disputes. The data validator will be responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, URS's policies, and USEPA requirements. The specific functions that he or a designee perform may include:

- Providing QA audits on various phases of the field operations
- Reviewing and approving the QA plans and procedures
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular

SECTION FOUR

Project Organization and Responsibilities

- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the URS Project Officer
- Data validation of sample results from the analytical laboratory, as appropriate.

4.3.2 URS QA Officer

Amelia Turnell will serve as the URS QA Officer (QAO). She will report directly to the URS Project Officer and will be responsible for verifying that all URS QA procedures for this project are being followed.

4.3.3 USEPA Region V Quality Assurance Reviewer

Ken Bardo, the USEPA Region V RPM, or a designee, will serve as the USEPA Region V Quality Assurance Reviewer. He will have the responsibility to review and approve the QAPP. In addition, he will be responsible for conducting external performance and system audits of the laboratory and field activities. He will also review and evaluate analytical laboratory and field procedures.

4.4 FIELD RESPONSIBILITIES

4.4.1 URS Field Team Leader

Jeff Adams, Steve Bunsen, or a designee, will serve as the URS Field Team Leader. The Field Team Leader will be responsible for leading, coordinating, and supervising the day-to-day field activities. His primary responsibilities include:

- Provision of day-to-day coordination with the URS Project Officer on technical issues
- Develop and implement field-related sampling plans and schedule
- Coordinate and manage field staff
- Supervise or act as the field sample custodian
- Implement the QC for technical data, including field measurements
- Adhere to work schedules
- Coordinate and oversee technical efforts of subcontractors assisting the field team

SECTION FOUR

Project Organization and Responsibilities

- Identify problems at the field team level, resolve difficulties in consultation with the URS Project Officer, implement and document corrective action procedures, and provide communication between team and upper management

4.4.2 URS Field Team

The technical staff will be drawn from URS' pool of resources. The technical staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. The technical staff consists of experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

4.4.3 Health and Safety Officer

The Health and Safety Officer will be responsible for implementing the site-specific health and safety directives in the Health and Safety Plan and documenting all health and safety related activities. The Field Team Leader may serve as the Site Health and Safety Officer.

SECTION FIVE

Non-Measurement Data Acquisition

5.1 TOPOGRAPHIC MAP AND SAMPLE LOCATION SURVEYING

Information submitted to USEPA Region V describing sampling locations will be identified in the field using a global positioning satellite (GPS) system or traditional land survey techniques. The GPS system will be capable of producing decimal latitude and longitude readings and it will have a horizontal accuracy of one meter or less.

5.2 AERIAL PHOTOGRAPH ACQUISITION AND ANALYSIS

Available historical air photographs have been reviewed to determine the presence of past waste disposal practices. Many of the photos are contained in the DOCC report. Information obtained from this exercise was used to determine the final locations of the sampling points described in this plan.

SECTION SIX

Field Operations Documentation

The field sampling team will maintain a set of field logbooks. Forms that will be used include: chain-of-custody, test boring logs, and field log data sheets. The appendices contain copies of some of these forms.

The field logbooks will contain tabulated results of field measurements and documentation of field instrument calibration activities. The field logbooks will also record the following:

- Personnel conducting the site activities, their arrival and departure times, and their destination at the site
- Incidents and unusual activities that occur on the site such as, but not limited to, accidents, breaches of security, injuries, equipment failures, or weather related delays
- Changes to the FSP and the HASP
- Daily information such as:
 - Work accomplished and the current site status
 - Equipment calibrations, repairs and results
 - Site work zones.

In the field sampler's individual bound field logbook, samplers will note, with permanent ink, meteorological data, equipment employed for sample collection, calculations, information regarding collection of QA/QC samples, and any other observations. All entries will be signed and dated, and any entry, which is to be deleted will have a single cross out which is signed and dated. The following sampling-related information will be recorded in the field logbook by the field sampling team:

- Project identification
- Sample number
- Sampling location
- Required analysis
- Date and time of sample collection
- Type and matrix of sample
- Sampling technique

SECTION SIX

Field Operations Documentation

- Preservative used, if applicable
- Sampling conditions
- Observations
- Initials of the sampler.

Photographs will be taken showing representative conditions of the work.

6.1 SAMPLE DOCUMENTATION

6.1.1 Sample Identification System

The sample identification system will involve the following:

- Soil samples will be labeled SOIL-WGK-S1-__FT where “SOIL” denotes a soil sample, “WGK” is the site designation, “S1” is the sequentially numbered sampling station, and “__FT” indicates the sample depth range (e.g., 0-2).
- “MS/MSD” or “DUP” at the end of a sample identification will indicate a matrix spike/matrix spike duplicate/spike duplicate or a duplicate sample, respectively.

6.1.2 Sample Labels

For proper identification in the field and proper tracking by the analytical laboratory, samples will be labeled in a clear and consistent fashion. Sample labels will be waterproof, or sample containers will be sealed in plastic bags.

A completed sample label will be attached to each investigative or QC sample. The following will be recorded with permanent ink on sample labels by the field sampling team:

- Project name and number
- Sample number identification
- Initials of sampler
- Required analysis
- Date and time of sample collection
- Analysis and preservative used, if applicable.

SECTION SIX

Field Operations Documentation

6.1.3 Chain-of-Custody Records

Chain-of-custody procedures will be instituted and followed throughout the sampling activities. Samples are physical evidence and will be handled according to strict chain-of-custody protocols. The field sampler is personally responsible for the care and custody of the sample until transferred. For proper identification in the field and proper tracking by the analytical laboratory, samples will be labeled in a clear and consistent fashion.

The following information will be recorded with permanent ink on the chain-of-custody by the field sampling team:

- Project identification and number
- Sample description/location
- Required analysis
- Date and time of sample collection
- Type and matrix of sample
- Number of sample containers
- Analysis requested/comments
- Sampler signature/date/time
- Air bill number.

The laboratory will assign a number for each sample upon receipt. That sample number will be placed on the sample label. The label will be attached to the sample container. A chain-of-custody document providing all information, signatures, dates, and other information, as required on the example chain-of-custody form in **Appendix E** will be completed by the field sampler and provided for each sample cooler. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the chain-of-custody. The field sampler will sign the chain-of-custody form when relinquishing custody, make a copy to keep with the field logbook, and include the original form in an air-tight plastic bag in the sample cooler with the associated samples.

SECTION SIX

Field Operations Documentation

6.2 FIELD ANALYTICAL RECORDS

Field analytical records will consist of field logbook entries for field instruments. Only direct reading instrumentation will be employed in the field. The use of a photoionization detector (PID), an explosimeter, and a real time aerosol monitor (RAM) will generate some measurements directly read from the meters following calibration by the respective manufacturer's recommendations. Such data will be written into field logbooks immediately after measurements are taken. Calibration records will also be recorded in the logbooks.

6.3 DATA MANAGEMENT AND RETENTION

The field data and documentation, as described in this section, will become a part of the final evidence file. The final evidence file will be the central repository for all documents, which constitute evidence relevant to sampling and analysis activities as described in this FSP and the QAPP. URS is the custodian of the evidence file and maintains the contents of evidence files for the site, including all relevant records, logs, field logbooks, pictures, subcontractor reports, and data reviews. The database management system may be managed by URS, or by another organization selected by Solutia.

Upon completion of the analyses, the URS QAO will begin assimilating the field and laboratory notes. In this way, the file for the samples will be generated. The final file for the samples will be stored at URS and will consist of the following:

- Laboratory data packages, including summary and raw data from the analysis of environmental and QC samples, chromatograms, mass spectra, calibration data, work sheets, and sample preparation notebooks
- Chain-of-custody records
- Data validation reports.

The following documentation will supplement the chain-of-custody records:

- Field logbooks and data
- Field collection report
- Photographs and drawings
- Progress and QA reports

SECTION SIX

Field Operations Documentation

- Contractor and subcontractor reports
- Correspondence.

The evidence file must be maintained in a secured, limited access area until all submittals for the project have been reviewed and approved, and for a minimum of six years-past the submittal date of the final report.

SECTION SEVEN

Personal Protective Equipment

The basic level of PPE to be used at the W.G. Krummrich Plant during intrusive and non-intrusive activities is a modification of OSHA Level D. PPE may be upgraded based on air monitoring results or at the discretion of the Project Manager and based on the Site Safety Officer's (SSO) recommendations.

Personal protective equipment (PPE) requirements for each level of protection for URS personnel are described in the HASP prepared for these field activities.

SECTION EIGHT

Sample Packaging and Shipping

A completed sample label will be attached to each investigative or QC sample and the sample placed in a shipping container. Information to be recorded on sample labels is described in Section 6.1.2. Information to be recorded on chain-of-custody forms is described in Section 6.1.3. The sample identification system used in the field is described in Section 6.1.1.

Sampling containers will be packed in such a way as to help prevent breakage and cross-contamination. Samples will be shipped in coolers, each containing a chain-of-custody form and ice and ice packs to maintain inside temperature at approximately 4°C. Sample coolers will then be sealed between the lid and sides of the cooler with a custody seal prior to shipment. The custody seal will be an adhesive-backed tape that easily rips if it is disturbed. Samples will be shipped as follows:

STL Savannah Laboratories
5102 LaRoche Ave.
Savannah, GA 31404

STL Laboratories Sacramento
880 Riverside Parkway
West Sacramento, CA 95605

Samples will not be sent to another laboratory without the permission of USEPA Region V. Sample transportation will comply with U.S. Department of Transportation regulations. Special sampling packing provisions will be made for samples requiring additional protection.

Samples will remain in the custody of the sampler until transfer of custody is completed. Transfer consists of:

- Delivery of samples to the laboratory sample custodian
- Signature of the laboratory sample custodian on the chain-of-custody document as receiving the samples, and signature of sampler as relinquishing the samples.

If a carrier is used to take samples between the sampler and the laboratory, a copy of the air bill must be attached to the chain-of-custody to maintain proof of custody.

SECTION NINE

Decontamination

Sampling activities will occur in widely separated locations. Therefore, personnel and equipment decontamination will be accomplished at each sampling area using temporary facilities. Section 9 of the HASP describes personnel and monitoring equipment decontamination procedures and supplies. PPE, disposable sampling equipment, cuttings, and field decontamination wastes will be collected at the point of generation and stored in temporary containers. PPE, solids, and liquids will be consolidated in separate bulk containers at a central area. The sampling procedures have been developed to minimize the quantity of waste generated.

SECTION TEN

Field Assessment/Inspection

The performance audit is an independent check to evaluate the quality of data being generated. The system audit is an on-site review and evaluation of the quality control practices, sampling procedures, and documentation procedures.

At the discretion of the URS PO, performance and system audits of field activities will be conducted to verify that sampling and analyses are performed in accordance with the procedures established in this FSP and the QAPP. The audits of field activities include two independent parts: internal and external audits.

The internal audits will be performed by the URS QAO. The external audits will be performed by USEPA Region V.

10.1 FIELD PERFORMANCE AND SYSTEM AUDITS

10.1.1 Internal Field Audits

Internal field audit responsibilities. Internal audits of field activities, including sampling and field measurements will be conducted by the URS QAO or her designee.

Internal field audit frequency. These audits will verify that all established procedures are being followed. Internal field audits will be conducted at least once at the beginning of the site sample collection activities and anytime thereafter as determined by the URS PO.

Internal field audit procedures. The audits will include examination of field sampling records, field instrumentation operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, and other elements of the field program. Follow up audits will be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the project. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation. The areas of concern in a field audit include:

- Sampling procedures
- Decontamination of sampling equipment, if applicable
- Chain-of-custody procedures
- Standard operating procedures

SECTION TEN

Field Assessment/Inspection

- Proper documentation in field notebooks
- Subcontractor procedures.

10.1.2 External Field Audits

External field audit responsibilities. External field audits may be conducted by USEPA Region V.

External field audit frequency. External field audits may be conducted at any time during the field operations. These audits may or may not be announced and are at the discretion of USEPA Region V.

Overview of the external field audit process. External field audits will be conducted according to the field activity information presented in this FSP and the QAPP.

SECTION ELEVEN

Corrective Action

Corrective action is the process of identifying, recommending, approving, and implementing measures to counter unacceptable procedures or out-of-control performance, which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Corrective action proposed and implemented will be documented in the regular quality assurance reports to management. Corrective action should only be implemented after approval by the URS PO or the URS PM. If immediate corrective action is required, approvals secured by telephone from the Project Officer should be documented in an additional memorandum.

For noncompliance problems, a formal corrective action program will be developed and implemented at the time the problem is identified. The person who identifies the problem will be responsible for notifying the URS PM, who in turn will notify the URS PO. Implementation of corrective action will be confirmed in writing through the same channels. Nonconformance with the established quality control procedures in the QAPP or FSP will be identified and corrected in accordance with the QAPP.

11.1 FIELD CORRECTIVE ACTION

Corrective action in the field can be needed when the sample network is changed (i.e., more or less samples, sampling location changes, and related modifications) or sampling procedures and/or field analytical procedures require modification due to unexpected conditions. Technical staff and project personnel will be responsible for reporting all suspected technical or QA nonconformances or suspected deficiencies of any activity or issued document by reporting the situation to the URS PM. The URS PM will be responsible for assessing the suspected problems in consultation with the URS PO and assessing the potential for the situation to impact the quality of the data. If the situation warrants reportable nonconformance requiring corrective action, a nonconformance report will be initiated by the URS PM.

The URS PM will be responsible for seeing that corrective actions for nonconformance are initiated by:

- Evaluating reported nonconformances
- Controlling additional work on nonconforming items
- Establishing disposition or action to be taken

SECTION ELEVEN

Corrective Action

- Maintaining a log of nonconformances
- Reviewing nonconformance reports and corrective actions taken
- Verifying nonconformance reports are included in the final site documentation in project files.

If appropriate, the URS Field Team Leader will verify that no additional work dependent on the nonconforming activity is performed until the corrective actions are completed. Corrective action for field measurements may include:

- Repeat the measurement to check the error
- Check for proper adjustments for ambient conditions, such as temperature
- Check the batteries
- Recalibration
- Check the calibration
- Replace the instrument or measurement devices
- Stop work (if necessary).

The URS Field Team Leader is responsible for site activities. In this role, the URS Field Team Leader, at times, is required to adjust the site programs to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person notifies the URS Field Team Leader of the anticipated change and implements the necessary changes after obtaining the approval of the URS Field Team Leader. The change in the program will be documented on the field change request (FCR) that will be signed by the initiators and the URS Field Team Leader. The FCR for each document will be numbered serially as required. The FCR will be attached to the file copy of the affected document. The URS Field Team Leader must approve the change in writing or verbally prior to field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated to determine the significance of any departure from established program practices.

The URS Field Team Leader is responsible for controlling, tracking, and implementing identified changes. Reports on changes will be distributed to affected parties, which includes USEPA Region V.

SECTION ELEVEN

Corrective Action

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The URS QAO will identify deficiencies and recommend corrective action to the URS PM. Implementation of corrective actions will be performed by the URS Field Team Leader and the field team. Corrective action will be documented in the quality assurance report to the project management.

Corrective actions will be implemented and documented in the field notebook. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by USEPA Region V.

The URS QAO and Laboratory QAO may identify the need for corrective action during either the data validation or data assessment. Potential types of corrective action may include resampling by the field team or re-injection or reanalysis of samples by the laboratory. These actions are dependent upon the ability to mobilize the field team or, whether the data to be collected is necessary to meet the required quality assurance objectives. When the URS QAO or Laboratory QAO identifies a corrective action situation, it is the URS PO who will be responsible for approving the implementation of corrective action, including resampling, during data assessment. Corrective-actions of this type will be documented by the URS QAO and the Laboratory QAO.

SECTION TWELVE

References

- Solutia, 1998. Status Report Hazardous Waste Management Unit Closure, October 1998. Prepared by Radian International.
- Solutia, 2000. Description of Current Conditions Report, August 1, 2000. Prepared by URS Corporation.

Tables

TABLE 1

Analytical Methods for Surface and Subsurface Soil Samples
WGK HEEI Investigation

PARAMETER	METHOD
VOCs	8260B
SVOCs	8270C
Pesticides	8081A
Herbicides	8151A
PCBs	680
Metals	6010B
Dioxins	8280A

TABLE 2
Collection and Analysis Summary
WGK HEEI Soil Investigation Field Sampling Plan

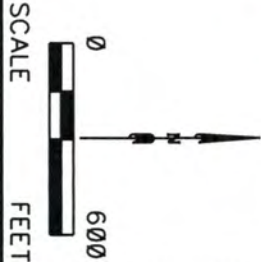
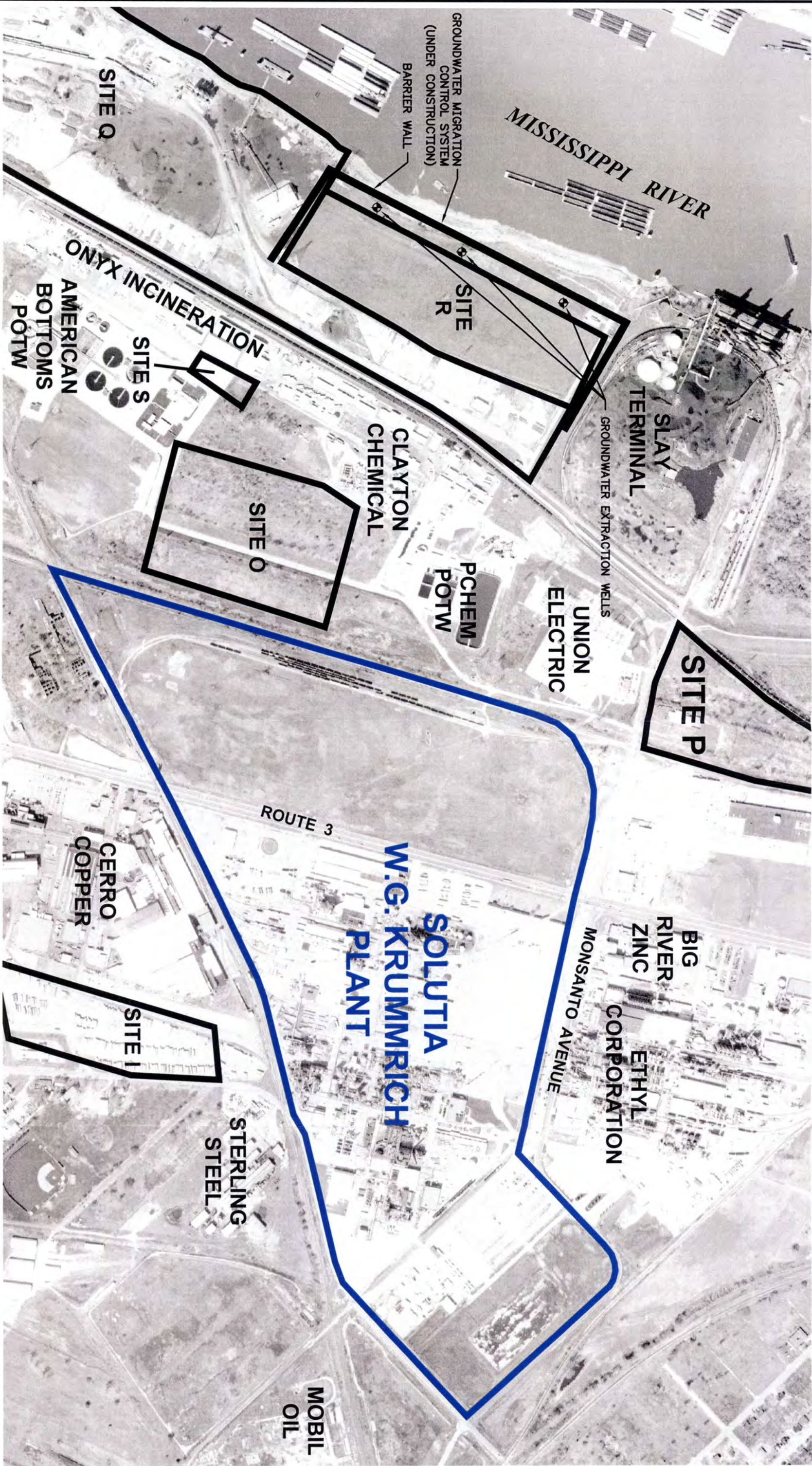
Parameters	Number of Investigative Samples Collected	Number of Field Blanks / Equipment Blanks	Number of Field Duplicates	Number of Matrix Spike / Matrix Spike Duplicates	Number of Trip Blanks	Sample Containers (number, size, type)	Preservation	Holding Time Extraction Analysis
VOC's	61 surface 60 subsurface	One per 10, or fraction of 10, samples collected (12)	One per 10, or fraction of 10, samples (12)	One per 20, or fraction of 20, samples collected (6)	One per sample cooler containing VOC analysis	3-Encore™ samplers (or in accordance with USEPA Method 5035)	4°C	Transferred to soil container or analyzed 48 hours from collection
SVOC's	61 surface 60 subsurface	One per 10, or fraction of 10, samples collected (12)	One per 10, or fraction of 10, samples (12)	One per 20, or fraction of 20, samples collected (6)	NA	250 mL wide mouth glass container with Teflon™-lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis;
Pesticides	31 surface 30 subsurface	One per 10, or fraction of 10, samples collected (6)	One per 10, or fraction of 10, samples (6)	One per 20, or fraction of 20, samples collected (4)	NA	250 mL wide mouth glass container with Teflon™-lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis
Herbicides	31 surface 30 subsurface	One per 10, or fraction of 10, samples collected (6)	One per 10, or fraction of 10, samples (6)	One per 20, or fraction of 20, samples collected (4)	NA	250 mL wide mouth glass container with Teflon™-lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis;
PCBs	47 surface 46 subsurface	One per 10, or fraction of 10, samples collected (10)	One per 10, or fraction of 10, samples (10)	One per 20, or fraction of 20, samples collected (5)	NA	500 mL wide mouth glass container	4°C	14 days from collection to extraction; 40 days from extraction to analysis

TABLE 2
Sample and Analysis Summary
WGK HEEI Soil Investigation Field Sampling Plan

Parameters	Number of Investigative Samples Collected	Number of Field Blanks / Equipment Blanks	Number of Field Duplicates	Number of Matrix Spike / Matrix Spike Duplicates	Number of Trip Blanks	Sample Containers (number, size, type)	Preservation	Holding Time Extraction Analysis
Dioxins	47 surface 46 subsurface	One per 10, or fraction of 10, samples collected (10)	One per 10, or fraction of 10, samples (10)	One per 20, or fraction of 20, samples collected (5)	NA	100 grams in 4 oz. Amber glass jar with Teflon™-lined lid	4°C	30 days from collection to extraction, 45 days from extraction to analysis; Extract all samples. Analyze only samples where PCBs or chlorophenols have exceeded DQLs
Metals	47 surface 46 subsurface	One per 10, or fraction of 10, samples collected (10)	One per 10, or fraction of 10, samples (10)	One per 20, or fraction of 20, samples collected (5)	NA	4 ounce wide mouth polyethylene or fluorocarbon (TFE or PFA) container	4°C	180 days from collection; Analyze all the shallow samples. When preliminary results are available compare results with DQLs. If DQLs are exceeded in the shallow samples, test the deeper samples.

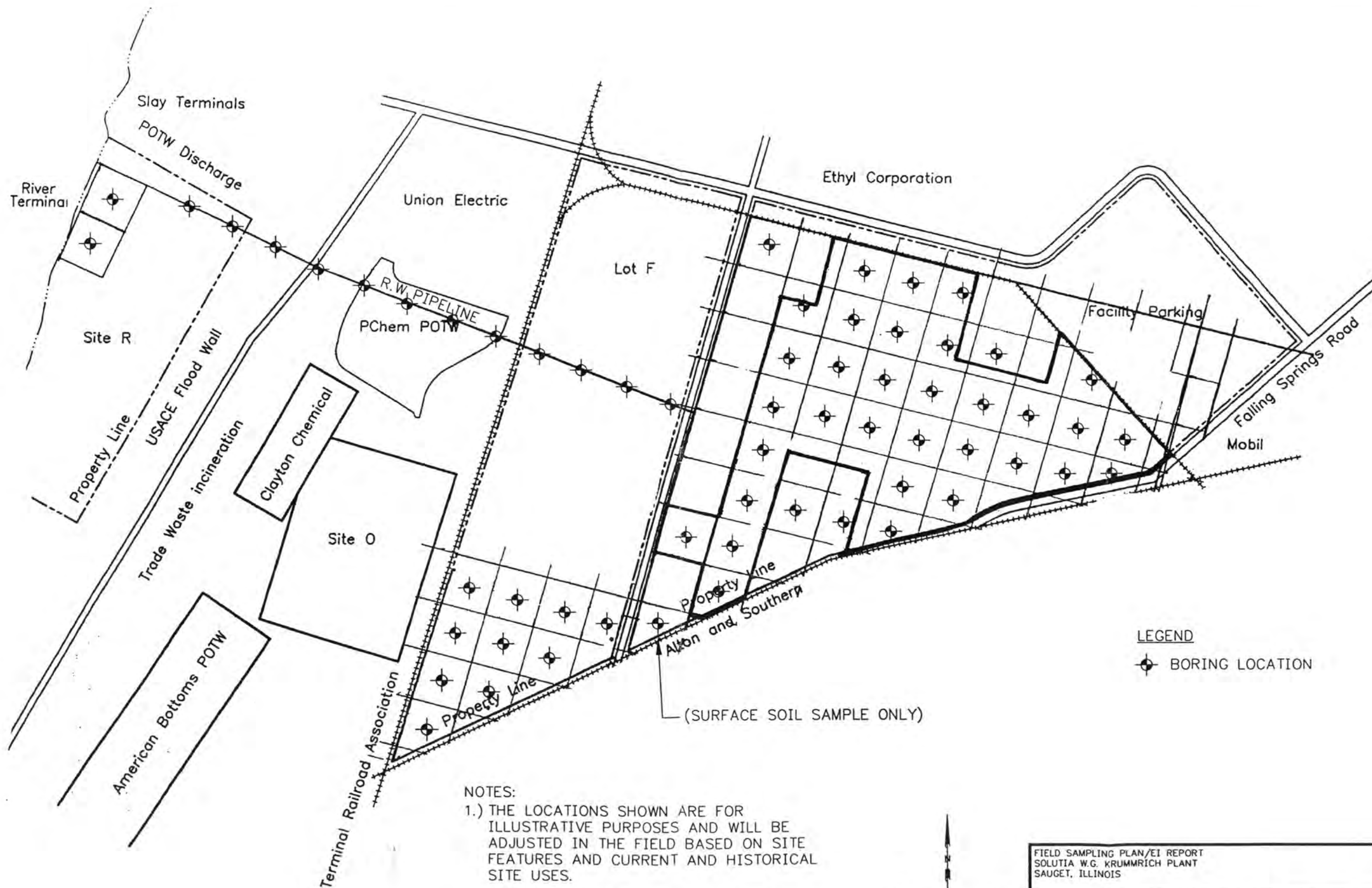
Figures

SOURCE: SURDEX AERIAL PHOTOGRAPHY DATED APRIL 2000.



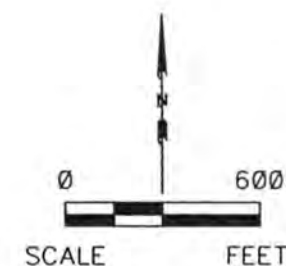
CA 750 MIGRATION OF CONTAMINATED GROUNDWATER UNDER CONTROL			PROJECT NO.
SOLUTIA W.G. KRUMMRICH PLANT			21561197.00001
SAUCET, ILLINOIS			
URS			
DRN. BY: dd 10/24/02	Site Location Map	FIG. NO.	
DSGN. BY: ot		1	
CHKD. BY:			

File: E:\21561197\00000\300 GRID.DWG Last edited: NOV. 25, 02 @ 4:57 p.m. by: DJDEGU10



NOTES:

- 1.) THE LOCATIONS SHOWN ARE FOR ILLUSTRATIVE PURPOSES AND WILL BE ADJUSTED IN THE FIELD BASED ON SITE FEATURES AND CURRENT AND HISTORICAL SITE USES.
- 2.) SURFACE SOIL SAMPLE ONLY DUE TO STAINED AREA AS OBSERVED ON AERIAL PHOTOGRAPH DATED 1964.



LEGEND

✦ BORING LOCATION

FIELD SAMPLING PLAN/EI REPORT
SOLUTIA W.G. KRUMMRICH PLANT
SAUGET, ILLINOIS

PROJECT NO.
21561197.00002

URS

DRN. BY: djd 11/15/02
DSGN. BY: ot
CHKD. BY:

BORING LOCATION MAP

FIG. NO.
2

APPENDIX A

Conceptual Site Model

**Conceptual Site Model
To Support
RCRA Environmental Indicators Evaluation
Current Human Exposures Under Control (CA-725)**

**Solutia W.G. Krummrich Facility
Sauget, Illinois**

This Conceptual Site Model (CSM) has been developed for the Solutia W.G. Krummrich facility to support the Environmental Indicator (EI) evaluation for human health (Current Human Exposures Under Control [CA-725]). The Solutia W.G. Krummrich facility is located in the Village of Sauget, Illinois. The facility and surrounding areas are highly industrialized, and have been so since the early 1900s. The area is zoned commercial/industrial and it is reasonably expected that these areas will continue as such for the foreseeable future.

The CSM, graphically depicted in **Figure 1**, identifies the potentially complete exposure pathways and the sources and mechanisms by which a human receptor might be exposed. The CSM reflects current use scenarios; future use scenarios are not considered for EI evaluations. The CSM helps in the identification of data needs for completion of the EI evaluation.

Constituents from historic releases at the facility have impacted surface and subsurface soils and, in some cases, have leached to groundwater. Volatile organic compounds (VOCs) present in soils and shallow groundwater may volatilize into outdoor air and may infiltrate into indoor air in overlying buildings. Groundwater is not used as a source of process or potable water in the area, and its use as a potable supply is prohibited by ordinance in the Village of Sauget. The Mississippi River is the primary discharge feature for groundwater in the area. Constituents in groundwater discharging to the river may pose a concern for ecological receptors.

Human receptors potentially affected by these releases are described in the following paragraphs. For consistency, the receptor groups are those identified in Question 3 of the EI form.

Workers

The primary human receptors of concern are site workers, and as such, are the focus of the discussion below. However, offsite workers will be evaluated where there is a possibility of excavation and contact with affected groundwater or inhalation of volatilized vapors from underlying soil and/or groundwater.

- Construction/Utility Worker

The construction/utility worker will be evaluated for potential exposure to constituents in surface and subsurface soils to depths of approximately 15 ft below ground surface (bgs). This is typically the maximum depth of utilities at the facility that could require maintenance. Additionally, in areas of the facility where groundwater is present at these depths, the construction/utility worker will be evaluated for potential contact with constituents in shallow groundwater. Exposure to the construction/utility worker could occur through:

- Incidental ingestion and inhalation of, and dermal contact with, constituents present in surface and subsurface soil, and groundwater.

- Outdoor Worker

Most of the facility areas are covered and/or there are exposure controls in place (e.g., excavation permit policy) to minimize or prevent exposure. The outdoor worker will be evaluated for potential exposure to constituents present in soil and groundwater as described below. Exposure to the outdoor worker could occur through:

- Incidental ingestion and inhalation of, and dermal contact with, constituents present in surface soil; and
- Inhalation of constituents volatilized from surface and subsurface soils and groundwater¹.

- Indoor Worker

There are only a few buildings at the facility that have basements. In addition, most buildings routinely occupied by workers, e.g., control rooms, are under positive pressure conditions that minimize or prevent accumulation of vapors. However, to address the few areas not as described above, the indoor site worker will be evaluated for potential exposure to constituents volatilized from surface and subsurface soil and groundwater.

Trespasser

Trespassers are not receptors of concern for this EI, based on current exposure conditions at the facility. The site properties are fenced and there is 24 hr/day security (including video surveillance and routine patrols). There are no special land features that would cause the facility to be attractive to trespassers. The Mississippi River in the area is primarily used for barge staging and loading/unloading, and is otherwise not conducive to human activities.

¹ Volatilization from groundwater will be evaluated for areas of the facility where groundwater is present at depths to approximately 30 ft.

Residential

Residential receptors do not pose a concern for the purposes of this EI. The closest residential areas are at least 1/2 mile from the facility boundaries. This area is hydraulically upgradient from the facility. Residential areas are not located above an area of known groundwater impact, and local ordinance prohibits installation of water wells for potable uses.

Day Care

Receptors in Day Care facilities do not pose a concern for the purposes of this EI. The nearest day care facilities are over 1.5 miles from the facility, and would not be affected by historical releases from the facility. They are not located above an area of known groundwater impact, and local ordinance prohibits installation of water wells for potable uses.

Recreation

The nearest park is over 1/4 mile from the facility. Although there are general recreation activities in the river, under current conditions, humans are not receptors of concern. The river bank is steep and rip-rap covered, and the current is swift along the shoreline. The area is primarily used for barge staging and loading/unloading, and is otherwise not conducive to human activities.

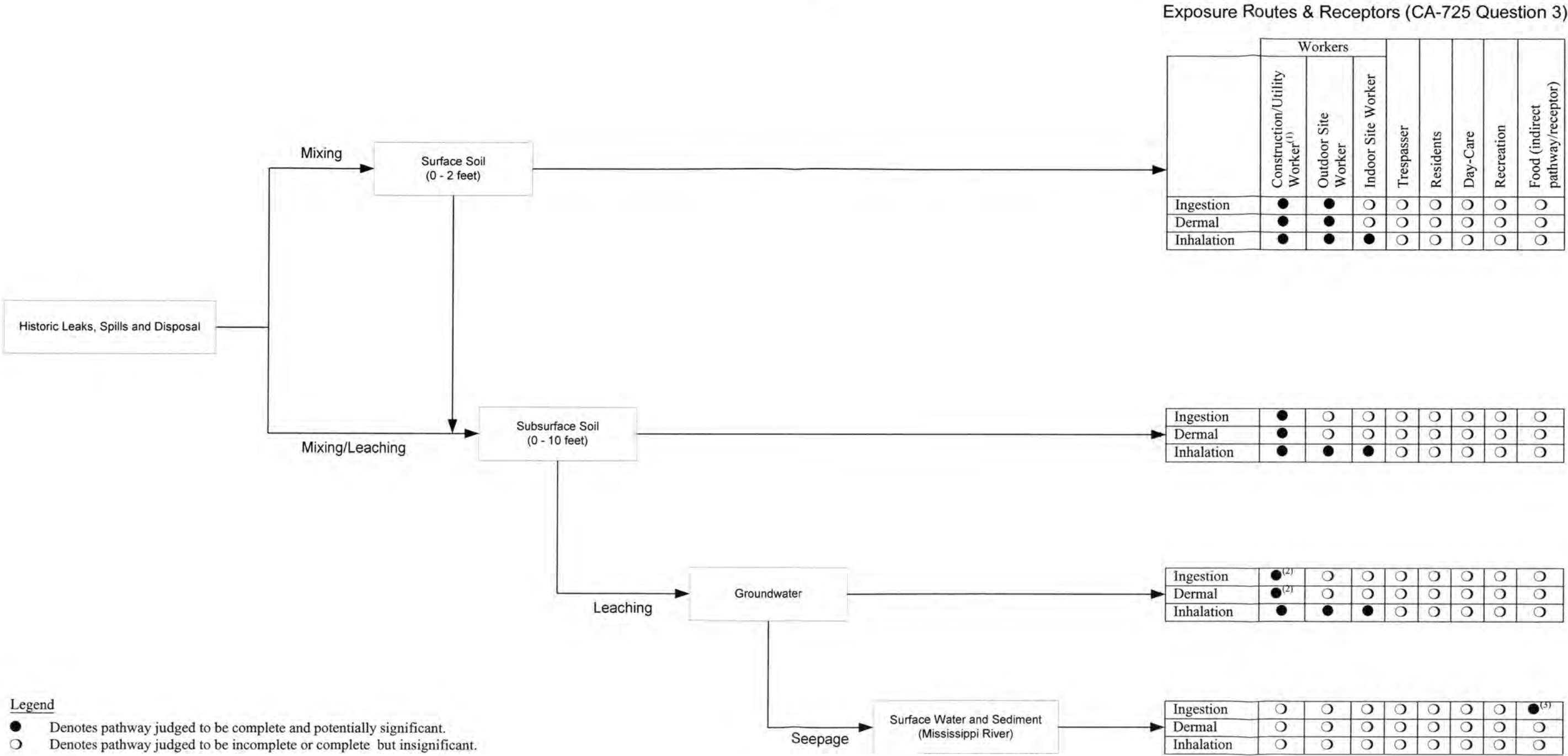
Food

Food crops (commercial scale) are not grown in this area. Recreational fishing in the Mississippi River is limited, but can occur. Potential indirect exposure to humans via consumption of fish will be evaluated.

Summary of Data Needs to Complete EI Evaluation

A significant amount of soil and groundwater data exist for the facility, and these data are summarized in the Description of Current Conditions (DOCC) report (Solutia, 2000). These data will be reviewed in the context of this CSM, the EI guidance, and Agency input, and data gaps will be identified and plans developed to acquire the necessary data. At this time, Solutia believes that additional data are needed to evaluate potentially complete soil and air (primarily indoor) pathways.

Figure 1
Site Conceptual Exposure Model
Solutia - W.G. Krummrich Plant RCRA Human Health Environmental Indicator Evaluation
CA-725



Legend

- Denotes pathway judged to be complete and potentially significant.
- Denotes pathway judged to be incomplete or complete but insignificant.

Notes

¹ For the construction/utility worker, there is no construction currently planned or anticipated, however this pathway could be complete in the near future (e.g., excavation to repair a broken water line), and as such is considered a potential “current” scenario for this EI.

² The construction/utility worker will be evaluated for potential contact with constituents in groundwater for areas of the plant where groundwater is present at depths less than 15 ft.

³ The potential for indirect exposure to humans via consumption of fish will be evaluated.

APPENDIX B

Soil Sampling Standard Operating Procedures (SOPs)

APPENDIX B

Soil Sampling SOPs

Surface Soil Sample Collection

Use the following procedure to collect a sample:

1. Borings will be advanced via direct push technology (Geoprobe®). The Geoprobe® will hydraulically drive a stainless steel, acetate-lined MacroCore® sampler (2-inch diameter by 4-foot length) to the desired surface sample depth.
2. Following sample collection, the sampler will be retrieved to the surface and the soil sample removed from the disposable acetate liner within the sampler.
3. Record the characteristics of the soils, including grain size, content, staining, and color.
4. To collect a discrete soil sample for VOC analysis, a 5-gram EnCore® sampler will be used. After pressing the sampler into the soil at the sampling location, cap the coring body while it is still in the EnCore® sampler T-handle. To collect a discrete soil sample for other parameters, use a stainless steel laboratory spoon or equivalent. Homogenize the non-VOC samples as necessary.
5. Place the homogenized sample into appropriate sample containers. In addition to analytical samples, a reference sample considered representative of the soil may also be collected in a wide mouth jar and stored for possible future physical analyses such as grain size analysis.
6. Check that the cap of each sample container has a Teflon® liner, if required for the analytical method. Secure the cap tightly.
7. Label the sample container with the appropriate sample tag. The tags could be permanent labels or clean tape. Label the tag carefully and clearly using indelible ink. Complete appropriate sampling forms and record in the field notebook. Pre-labeled containers are handy, particularly if you are wearing gloves or if the weather is inclement.
8. Initiate the chain-of-custody form.
9. Place the capped EnCore® sampler core bodies and other sample containers on ice in a cooler to maintain the samples at approximately 4°C. Ship the cooler to the laboratory for analysis within 48 hours of sample collection.
10. Decontaminate equipment between sample locations and after use as described below.

APPENDIX B

Soil Sampling SOPs

Subsurface Soil Sample Collection

The sampling procedure will be as follows.

1. Borings will be advanced via direct push technology (Geoprobe®). The Geoprobe® will hydraulically drive a stainless steel, acetate-lined MacroCore® sampler (2-inch diameter by 4-foot length) to the desired subsurface sample depth. Following sample collection, the sampler will be retrieved to the surface and the soil sample removed from the disposable acetate liner within the sampler.
2. Recovered soil samples will be screened in the field for evidence of impact with visual and olfactory observation and a photoionization detector (PID). The soil interval exhibiting the greatest impact will be submitted to the laboratory for analysis.
3. A 5-gram EnCore® sampler will be used to collect VOC samples from the subsurface soil. Use the EnCore® sampler to collect a VOC sample from the top portion of sample in the MacroCore® sampler.
4. Descriptive logs of each boring will be prepared as described in Appendix C.
5. Follow chain-of-custody procedures.
6. All borings will be grouted to the surface, following retrieval of both the waste and soil samples.

Boring equipment will be decontaminated and investigation-derived waste will be disposed of as described below.

APPENDIX C

Guidance for Soil Sample Logs and Example Boring Log

APPENDIX C

Guidance for Soil Sample Logs and Example Boring Log

At the outset of sample logging, the on-site geologist will record field notes with waterproof ink in a bound field notebook. At a minimum, the daily field notes will include:

- Project name and number
- Date and time
- Weather conditions
- Sampler's name
- Project objective(s).

Throughout the sampling round, the following items will be recorded as appropriate:

- Sample location(s)
- Sample identifications
- Limiting field conditions
- Problems encountered.

A copy of the boring log to be used is included as Appendix D.

Unconsolidated soil samples will be described as follows:

- Descriptive information:
 - Color name (Munsell Color Chart) of the logged interval or sample
 - Color notation including chroma, hue, value, and qualifiers
1. Mottling with abbreviations, descriptors, and criteria for descriptions of mottles as identified below

Descriptors for Mottling

Abundance	Size	Contract
f: few (<2%)	fine (<5 mm)	faint
c: common (2%-20%)	medium (5-15 mm)	distinct
m: many (>20%)	coarse (>15 mm)	prominent

2. Degree of saturation (dry, damp, moist, wet, saturated, or combinations); note depth to groundwater table, if observed

APPENDIX C

Guidance for Soil Sample Logs and Example Boring Log

3. Degree of density. Count the blows of each 12-inch increment of the sampler (ASTM-1586-84). Use the values and the density table presented below to determine the degree of density.

Degree of Density

Cohesive Clays		Non-cohesive Granular Soils	
0-2	very soft	0-3	very loose
2-4	soft	4-9	loose
5-7	firm	10-29	medium dense
8-15	stiff	30-49	dense
16-29	hard	50-80	very dense
30-49	very hard	80+	extremely dense
50-80	extremely hard		

4. Soil description according to ASTM's Unified Soil Classification System (USC) and by soil structure:

- ASTM Unified Soil Classification: The Grade Limits and Grade Standards table presented below provides the grade limits and grade names used by engineers according to ASTM standards D422-63 and D643-78.

Grade Limits and Grade Standards

Grade Limits		Grade Names	
mm	inch	US standard sieve series	
			boulders
305	12.0		
			cobbles
76.2	3.0	3.0 inch	
			gravel
4.75	0.19	No. 4	
2.00	0.08	No. 10	
			medium sand
0.425		No. 40	
0.074		No. 200	
			silt
0.005			clay size

Source: AGI data sheet 29.2

- Course-grained soils include clean gravels and sands and silty or clayey gravels and sands with more than 50% retained on the No. 200 sieve. A table of USC symbols and names for coarse-grained soils is presented below.

APPENDIX C

Guidance for Soil Sample Logs and Example Boring Log

USCS Symbols and Names for Coarse-grained Soils

USCS Symbol	Typical Names
GW	Well graded gravels, gravel-sand mixtures, little or no fines
GP	Poorly graded gravels, gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well graded sands, gravelly sands, little or no fines
SP	Poorly graded sands, gravelly sands, little or no fines
SM	Silty sand, sand-silt mixtures
SC	Clayey sands, sand-clay mixtures

- Fine-grained soils include inorganic and organic silts and clays; gravelly, sandy, or silty clays; and clayey silts with more than 50% passing the No. 200 sieve. A table of USC symbols and names for fine-grained soils is presented here.

USCS Symbols and Names for Fine-grained Soils

USCS Symbol	Typical Names
ML	Inorganic silts and very fine sands, rock flour, silty, or clayey fine sands, or clayey silts with slight plasticity
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
CH	Inorganic clays or high plasticity (residual clays), fat clays
OH	Organic clays of medium to high plasticity, organic silts
Pt	Peat and other highly organic soils

A table of soil descriptors is presented below. (this goes with #4, needs hyphenated bullet)

Soil Descriptors

Calcareous:	containing appreciable quantities of calcium carbonate
Fissured:	containing shrinkage cracks, often filled with fine sand or silt, usually more less vertical
Interbedded:	containing alternating layers of different soil types

APPENDIX C

Guidance for Soil Sample Logs and Example Boring Log

Soil Descriptors

Intermixed:	containing appreciable, random, and disoriented quantities of varying color, texture, or constituency												
Laminated:	containing thin layers of varying color, texture, or constituency												
Layer:	thickness greater than 3 inches												
Mottled:	containing appreciable random speckles or pockets of varying color, texture, or constituency												
Parting:	paper thin												
Poorly graded (well sorted):	primarily one grain size, or having a range of sizes with some intermediate size missing												
Slickensided:	having inclined planes of weakness that are slick and glossy in appearance and often result in lower unconfined compression cohesion												
Split graded:	containing two predominant grain sizes with intermediate sizes missing												
Varved:	sanded or layered with silt or very fine sand (cyclic sedimentary couplet)												
Well graded (poorly sorted):	containing wide range of grain sizes and substantial amounts of all intermediate particle sizes												
Modifiers:	<table> <tr> <td>Predominant</td><td>50% to 100%</td></tr> <tr> <td>type -</td><td></td></tr> <tr> <td>Modifying</td><td>12% to 50%</td></tr> <tr> <td>type -</td><td></td></tr> <tr> <td>With -</td><td>5% to 12%</td></tr> <tr> <td>Trace -</td><td>1% to 5%</td></tr> </table>	Predominant	50% to 100%	type -		Modifying	12% to 50%	type -		With -	5% to 12%	Trace -	1% to 5%
Predominant	50% to 100%												
type -													
Modifying	12% to 50%												
type -													
With -	5% to 12%												
Trace -	1% to 5%												

5. Degree of plasticity. The following table presents the terms used to denote the various degrees of plasticity of soil that passes the No. 200 sieve.

Degrees of Plasticity

Descriptive Term	Degree of Plasticity	Plasticity Index Range
SILT	none	non-plastic
Clayey SILT	slight	1-5
SILT & CLAY	low	5-10
CLAY & SILT	medium	10-20
Silty CLAY	high	20-40
CLAY	very high	over 40

6. Drilling information:

- Drill rig manufacturer, model, and driller (if applicable)
- Geologist or geotechnical engineer
- Project name, sample point identification, and location

APPENDIX C

Guidance for Soil Sample Logs and Example Boring Log

- Date samples obtained (and times if required)
- Type of sampler (e.g., split spoon, Shelby, California), measurements or method of advancing boring or equipment, method of driving sampler, and weight of hammer
- Drill fluids (if applicable)
- Ground surface or grade elevation (if known)
- Depth penetrated and blow counts/6-inch interval of penetration for ASTM 1586-84 and sample number (if applicable)
- Closed hole intervals and advancement (if applicable)
- Recovery
- Strata changes and changes within samples
- Sampling tool behavior
- Drill string behavior
- Use(s) of borehole
- Disposition(s) of residual soil or cuttings
- Signature or sampling of log (as required)

URS

LOG OF BORING

SHEET 1 of 1

PROJECT NAME/NUMBER		DATE STARTED		DATE COMPLETED	
LOCATION		GROUND ELEVATION (FT. MSL)		WATER DEPTH (FT BGS):	
DRILLING CONTRACTOR	FOREMAN	COMPLETION DEPTH (FT BGS)		ROCK DEPTH (FT BGS)	
DRILLING EQUIPMENT		BORING LOCATION			
GEOLOGIST/ENGINEER					

DESCRIPTION	Sample Run	Depth (FT BGS)	Water Table	SAMPLES		USC	PID Readings Head Space (ppm)	REMARKS
				Recov. (n)	Time			
		- 0 -						
		- 1 -						
		- 2 -						
		- 3 -						
		- 4 -						
		- 5 -						
		- 6 -						
		- 7 -						
		- 8 -						
		- 9 -						
		- 10 -						
		- 11 -						
		- 12 -						
		- 13 -						
		- 14 -						
		- 15 -						
		- 16 -						
		- 17 -						
		- 18 -						
		- 19 -						
		- 20 -						

APPENDIX D

Quality Assurance/Quality Control (QA/QC) SOPs

APPENDIX D

Quality Assurance/Quality Control (QA/QC) SOPs

QA/QC samples will consist of:

- One duplicate per ten, or fraction of ten, environmental samples collected
- One MS/MSD per twenty, or fraction of twenty, environmental samples collected
- One field blank (or equipment blank) per ten, or fraction of ten, environmental samples collected
- One trip blank for each sample cooler containing samples for VOC analysis.

Duplicate samples are collected to measure consistency of field sampling techniques. MS/MSD (matrix spike/matrix spike duplicates) are collected to measure laboratory quality control procedures. The field blank will be submitted to the laboratory with the investigative samples and analyzed for the same parameters as the investigative samples. The minimum required is one per ten, or fraction of ten, environmental samples collected, unless dedicated or disposable sampling equipment is used to collect samples.

APPENDIXE

Sample Chain-of-Custody

CHAIN OF CUSTODY RECORD

URS CORPORATION

Sheet ___ of ___

2318 MILLPARK DR.
MARYLAND HEIGHTS, MISSOURI 63043
314-429-0100

PROJECT NO:		PROJECT NAME:		NO. OF CONTAINERS	CONTAINER DESCRIPTION / ANALYSES REQUESTED					REMARKS
SAMPLER'S: (Signature)										
DATE	TIME	SAMPLE I.D. NUMBER								
RELINQUISHED BY: (Signature)			DATE / TIME		RECEIVED BY: (Signature)			DATE / TIME		
RELINQUISHED BY: (Signature)			DATE / TIME		RECEIVED AT LAB BY: (Signature)			DATE / TIME		
METHOD OF SHIPMENT:					AIRBILL NO:					

QUALITY ASSURANCE
PROJECT PLAN
RCRA ENVIRONMENTAL
INDICATOR FOR CURRENT
HUMAN EXPOSURE (CA-725)

W.G. KRUMMRICH PLANT
SAUGET, ILLINOIS

Prepared for
W.G. Krummrich Plant
520 Monsanto Avenue
Sauget, Illinois 62206



November 2002

URS

URS Corporation
2318 Millpark Drive
Maryland Heights, MO 63043
(314) 429-0100
Project #21561197.00002

QUALITY ASSURANCE
PROJECT PLAN
RCRA ENVIRONMENTAL
INDICATOR FOR CURRENT
HUMAN EXPOSURE (CA-725)

W.G. KRUMMRICH PLANT
SAUGET, ILLINOIS

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November 2002



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Project #21561197.00002

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GLOSSARY OF ACRONYMS AND ABBREVIATIONS

%D	Percent difference
%R	Percent recovery
ABRTF	American Bottoms Regional Treatment Facility
AOC	Administrative order by consent
ARARs	Applicable or relevant and appropriate requirements
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CLP	Contract laboratory program
COCs	Constituents of concern
CRDL	Contract required detection limits
DBMS	Database management system
DHU	Deep hydrogeologic unit
DQL	Data quality limits
DQO	Data quality objective
DSR	Duplicate sample result
EDD	Electronic disk deliverable
E&E	Ecology and Environment
ERA	Ecological risk assessment
FCR	Field change request
FSP	Field sampling plan
GC/MS	Gas chromatograph/mass spectrometer
HHRA	Human health risk assessment
HRGC	High-resolution gas chromatography
HRMS	High-resolution mass spectrometry
ICP	Inductively coupled plasma
LCS	Laboratory control sample
MDL	Method detection limit
MHU	Middle hydrogeologic unit
MS	Matrix spike
MSL	Mean Sea Level
MS/MSD	Matrix spike/matrix spike duplicate
MSD	Matrix spike duplicate
NIST	National Institute of Standards and Technology
OM	Operations manager
OSR	Original sample result
PCBs	Polychlorinated biphenyls
PCDD	Polychlorinated dibenzodioxin
PCDF	Polychlorinated dibenzofuran
PID	Photoionization detector
PM	Project manager
PQL	Practical quantitation limit
QA	Quality assurance
QC	Quality control
QA/QC	Quality assurance/quality control
QAM	Quality assurance management
QAO	Quality assurance officer
QAPP	Quality assurance project plan
RAM	Real-time aerosol monitor
RI/FS	Remedial investigation/feasibility study

GLOSSARY OF ACRONYMS AND ABBREVIATIONS

RPD	Relative percent difference
RPM	Remedial project manager
RSD	Relative standard deviation
SHU	Shallow hydrogeologic unit
SOP	Standard operating procedure
SR	Sample result
SVOC	Semivolatile organic compound
TCLP	Toxicity characteristic leaching procedure
TOC	Total organic carbon
URS	URS Corporation
USCOE	United States Corp of Engineers
USEPA	United States Environmental Protection Agency
VOC	Volatile organic compound

SECTION ONE

Project Description

1.0 ADMINISTRATIVE INFORMATION

Client Name:	Solutia, Inc.
Site Location:	Sauget, Illinois
Program Manager:	Robert Billman
Project Manager:	Jeff Adams
Site Safety Officer:	To be determined
Effective Dates:	November 2002 to December 2003

APPROVAL:

Robert Billman
URS Project Officer

Date

Amelia Turnell
URS Quality Assurance Officer

Date

Jack Tuschall, Ph.D.
STL – Savannah General Manager

Date

Richard Williams
Solutia Project Manager

Date

Ken Bardo
USEPA Region V RPM

Date

SECTION ONE

Project Description

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) has been prepared by URS Corporation (URS) on behalf of Solutia Inc. as part of the RCRA Environmental Indicator (EI) evaluation for current human exposures at the W.G. Krummrich Plant in the Village of Sauget, Illinois. This QAPP provides objectives, organization, functional activities, and specific Quality Assurance (QA) and Quality Control (QC) activities for sampling, sample handling and storage, chain of custody, and laboratory and field analysis efforts associated with sampling of environmental media for this project.

This QAPP was developed using the following documents as guidance:

- USEPA Region V *Model Quality Assurance Project Plan (QAPP) Revision 1* (USEPA, 1996b)
- USEPA *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*. QAMS-005-80 (USEPA, 1980)
- USEPA *Requirements for Quality Assurance Project Plans for Environmental Data Operation*, USEPA QA/R-5, (USEPA, 1994b).

The following quality assurance topics are addressed in this QAPP:

- Project description
- Project organization and responsibilities
- Quality assurance objectives for measurement
- Sampling procedures
- Custody procedures
- Calibration procedures and frequency
- Analytical procedures internal quality control checks
- Data reduction, validation, and reporting
- Performance and system audits
- Preventative maintenance

SECTION ONE

Project Description

- Specific routine procedures used to assess data precision, accuracy, and completeness
- Corrective action
- Quality assurance reports to management.

A complete site description for the W.G. Krummrich Plant is provided in the Description of Current Conditions Report (DOCC) dated August 1, 2000 (Solutia, 2000). This reference contains a discussion of site location, physical setting, present and past facility operations and disposal practices, regional and site-specific geology, hydrology, and hydrogeology, current and past groundwater uses, surrounding land use and populations, sensitive ecosystems, and meteorology/climatology.

1.2 PROJECT OBJECTIVES

The purpose of the work is to gather sufficient information from the W.G. Krummrich Plant to complete the Current Human Exposure EI Report. The collected data will be used to prepare a Human Health Risk Assessment (HHRA). The Field Sampling Plan (FSP) includes a description of the sample collection protocols, sample locations, number of samples, and analytical methods.

The purpose of the QAPP is to describe the guidelines to be followed in implementing the FSP to ensure that the data collected and the decisions made based on those data are technically sound, valid, and properly documented. Data Quality Objectives (DQOs), according to USEPA's guidance (EPA 1993), are statements that identify data uses, data types, data quantity and quality (including reporting limits), and ensure that the collected data will fulfill the sampling program project objectives.

The analytical methods to be used will be SW-846 methods and are presented in **Table 1**.

The main components of the FSP addressed in this QAPP include:

- Surface soil sampling
- Subsurface soil sampling.

Key elements of a data collection and quality assurance program include a description of the data collection strategy, procedures for sample selection and collection, procedures for field measurements, and procedures for ensuring sample integrity. The rationale and strategy of the investigation program design is presented in the FSP. This QAPP specifies the procedures that

SECTION ONE

Project Description

will be implemented to ensure that the sampling and analysis activities are consistent with the project quality goals.

1.3 PROJECT SCHEDULE

The estimated project schedule is presented in the FSP. It is estimated that the field investigation, laboratory analysis of samples collected, data interpretation, and submittal of the FSP report will take approximately 4 to 5 months from the workplan approval.

SECTION TWO

Project Organization and Responsibility

URS will perform the soil sampling activities, validate and interpret the data, prepare the report and provide project management for support sampling activities. Analytical services for this QAPP will be provided by Severn-Trent Laboratories located in Savannah, Georgia and Sacramento, California. ENSR will perform the Human Health Risk Assessment. The various quality assurance and management responsibilities of key project personnel are defined below.

2.1 PROJECT ORGANIZATION

Sections 2.2 through 2.5 of this QAPP present the responsibilities of the key project personnel, and the lines of authority for the project personnel are described in each section.

2.2 MANAGEMENT RESPONSIBILITIES

2.2.1 USEPA Region V Remedial Project Manager

The USEPA Region V Remedial Project Manager (USEPA RPM) for this project will be Ken Bardo.

2.2.2 Solutia Project Manager

Richard Williams of Solutia Inc. will serve as the Solutia Project Manager. As such, he will have the overall responsibility for all phases of the work. He will be responsible for implementing the project, and will have the authority to commit the resources necessary to meet project objectives and requirements. His primary function is to verify that technical, financial, and scheduling objectives are achieved successfully. He will provide the major point of contact and control for matters concerning the project. The Solutia Project Manager will:

- Define project objectives and develop a sampling plan schedule
- Establish project policy and procedures to address the specific needs of the project as a whole, as well as the objectives of each task
- Acquire and apply technical and financial resources as needed to verify performance within budget and schedule constraints
- Monitor and direct the field leaders
- Develop and meet ongoing project staffing requirements
- Review the work performed on each task to verify its quality, responsiveness, and

SECTION TWO

Project Organization and Responsibility

timeliness

- Review and analyze overall task performance with respect to planned requirements and authorizations
- Approve reports before their submission to USEPA Region V
- Ultimately be responsible for the preparation and quality of reports
- Represent Solutia at meetings.

2.2.3 URS Project Officer

Robert Billman will serve as the URS Project Officer. He will be responsible for the overall administration and technical execution of the project. He will report directly to the Solutia Project Manager.

2.2.4 URS Project Manager

Jeff Adams will serve as the URS Project Manager (PM). He will have overall responsibility for verifying that the project meets the stated objectives and URS's quality standards. He will report directly to the URS Project Officer and is responsible for technical quality control and project oversight.

2.3 QUALITY ASSURANCE (QA) RESPONSIBILITIES

2.3.1 URS Data Validator

John Kearns of URS will serve as the lead third party data validator. He will remain independent of direct job involvement and day-to-day operations and have direct access to corporate executive staff as necessary to resolve QA disputes. The data validator will be responsible for auditing the implementation of the QA program in conformance with the demands of specific investigations, URS's policies, and USEPA requirements. The specific functions that he or a designee perform may include:

- Providing QA audits on various phases of the field operations
- Reviewing and approving the QA plans and procedures
- Reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the URS Project Officer

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Project Organization and Responsibility

- Data validation of sample results from the analytical laboratory, as appropriate.

2.3.2 URS QA Officer

Amelia Turnell will serve as the URS QA Officer (QAO). She will report directly to the URS Project Officer and will be responsible for verifying that all URS QA procedures for this project are being followed.

2.3.3 USEPA Region V Quality Assurance Reviewer

Ken Bardo, the USEPA Region V RPM, or a designee, will serve as the USEPA Region V Quality Assurance Reviewer. He will have the responsibility to review and approve the QAPP. In addition, he will be responsible for conducting any external performance and system audits of the laboratory and field activities. He will also review and evaluate analytical laboratory and field procedures.

2.4 FIELD RESPONSIBILITIES

2.4.1 URS Field Team Leader

Jeff Adams, Steven Bunsen, or a designee, will serve as the URS Field Team Leader. The Field Team Leader will be responsible for leading, coordinating, and supervising the day-to-day field activities. His responsibilities include:

- Provision of day-to-day coordination with the URS Project Officer on technical issues
- Develop and implement field-related sampling plans and schedule
- Coordinate and manage field staff
- Supervise or act as the field sample custodian
- Implement the QC for technical data, including field measurements
- Adhere to work schedules
- Coordinate and oversee technical efforts of subcontractors assisting the field team
- Identify problems at the field team level, resolve difficulties in consultation with the URS Project Officer, implement and document corrective action procedures, and provide communication between team and upper management

SECTION TWO

Project Organization and Responsibility

2.4.2 URS Field Team

The technical staff will be drawn from URS' pool of resources. The technical staff will be utilized to gather and analyze data, and to prepare various task reports and support materials. The technical staff consists of experienced professionals who possess the degree of specialization and technical competence required to effectively and efficiently perform the required work.

2.4.3 Health and Safety Officer

The Health and Safety Officer will be responsible for implementing the site-specific health and safety directives in the Health and Safety Plan and documenting all health and safety related activities. The Field Team leader may serve as the Site Health and Safety Officer.

2.5 LABORATORY RESPONSIBILITIES

2.5.1 Laboratory Project Manager

Laboratory project managers will report directly to the URS QA Officer and will be responsible for the following:

- Ensuring the resources of the laboratory are available on an as-required basis
- Reviewing the final analytical report
- Approving final analytical reports prior to submission to the data validation contractor.

2.5.2 Laboratory Operations Manager (OM)

Laboratory operations managers will report to their respective Laboratory PM and will be responsible for:

- Coordinating laboratory analysis
- Supervising in-house chain-of-custody
- Scheduling sample analysis
- Overseeing data review
- Overseeing preparation of analytical reports
- Approving final analytical reports.

SECTION TWO

Project Organization and Responsibility

2.5.3 Laboratory Quality Assurance Officer

Laboratory quality assurance officers will have overall responsibility for data after it is released by the analyst and before it is released by the laboratory. The Laboratory QAO will be responsible for the following:

- Overseeing laboratory quality assurance
- Overseeing Quality Assurance/Quality Control (QA/QC) documentation
- Conducting detailed data review
- Deciding whether to implement laboratory corrective actions, if required
- Defining appropriate laboratory QA procedures
- Preparing laboratory standard operation procedures (SOPs)
- Approving the laboratory QAPP.

2.5.4 Laboratory Sample Custodian

Laboratory sample custodians will report to their respective Laboratory OM. Their responsibilities will include the following:

- Receiving and inspecting the incoming sample containers
- Recording the condition of the incoming sample containers
- Signing appropriate documents
- Verifying the chain-of-custody and its correctness
- Notifying the Laboratory PM of sample receipt and inspection
- Assigning a unique identification number and entering each into the sample receiving log
- Controlling and monitoring access and storage of samples.

Final responsibility for the project quality rests with the URS Project Officer. Independent quality assurance will be provided by each Laboratory PM and Laboratory QAO prior to release of all data to URS.

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Project Organization and Responsibility

2.5.5 Laboratory Technical Staff

The laboratory technical staff will be responsible for sample analysis and identification of corrective actions. The staff will report directly to their respective Laboratory OM.

SECTION THREE

Quality Assurance Objectives for Measurement

The overall QA objective for this QAPP is to develop and implement procedures for field sampling, chain-of-custody, laboratory analysis, data measurement and reporting providing data to a degree of quality consistent with its intended use and legally defensible in a court of law. Quality assurance objectives for measurement data are usually expressed in terms of precision, accuracy, completeness, representativeness, and comparability. The investigation will not be considered invalid if these criteria are not fully achieved but variances will trigger QA/QC measures to evaluate, and correct if necessary, any problem areas.

The control limits for precision and accuracy as well as detection limits for each laboratory analysis are listed in **Tables 2A** through **2E**.

3.1 PRECISION

3.1.1 Definition

Precision is a measure of the degree to which two or more measurements are in agreement.

3.1.2 Field Precision Objectives

Field precision is assessed through the collection and measurement of field duplicates at a rate of one duplicate per ten analytical samples. The total number of duplicates for this QAPP is found in **Table 3**.

3.1.3 Laboratory Precision Objectives

Precision in the laboratory is assessed through the calculation of relative percent differences (RPD) for two or more replicate samples. The equations to be used for precision in this QAPP are presented in Chapter 12 of this QAPP. Precision control limits are presented in **Tables 2A** through **2E**.

3.2 ACCURACY

3.2.1 Definition

Accuracy is the degree of agreement between an observed value and an accepted reference value.

3.2.2 Field Accuracy Objectives

Accuracy in the field is assessed through the use of field and trip blanks and through the adherence to all sample handling, preservation, and holding times.

SECTION THREE

Quality Assurance Objectives for Measurement

3.2.3 Laboratory Accuracy Objectives

Laboratory accuracy is assessed through the analysis of matrix spikes (MS) or laboratory control samples (LCSs), and the determination of percent recoveries. The equation to be used for accuracy in this QAPP is presented in Chapter 12. Accuracy control limits are presented in Tables 2A through 2E.

3.3 COMPLETENESS

3.3.1 Definition

Completeness is a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

3.3.2 Field Completeness Objectives

Field completeness is a measure of the amount of valid measurements obtained from all the measurements taken in the project. Field completeness for this project will be greater than 90 percent. In the event that the field completeness target of greater than 90 percent is not achieved, additional samples may be collected and analyzed so that the 90 percent goal will be achieved or a report will be issued explaining why the goal was not met and if the task can be considered complete.

3.3.3 Laboratory Completeness Objectives

Laboratory completeness is a measure of the amount of valid measurements obtained from all the laboratory measurements taken in the project. The equation for completeness is presented in Chapter 12 of this QAPP. Laboratory completeness for this project will be greater than 95 percent. In the event that the laboratory completeness target of greater than 95 percent is not achieved, additional samples may be collected and analyzed so that the 95 percent goal will be achieved or a report will be issued explaining why the goal was not met and if the task can be considered complete.

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Quality Assurance Objectives for Measurement

3.4 REPRESENTATIVENESS

3.4.1 Definition

Representativeness expresses the degree to which data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition.

3.4.2 Measurement to Ensure Representativeness of Field Data

Representativeness is dependent upon the proper design of the sampling program and will be satisfied by ensuring that the FSP is followed and that proper sampling techniques are used.

3.4.3 Measures to Ensure Representativeness of Laboratory Data

Representativeness in the laboratory data is ensured by using the proper analytical procedures, meeting sample holding times, and analyzing and assessing the field duplicate samples and matrix spike duplicate samples. The sampling network is designed to provide data representative of site conditions. During development of this network, consideration is given to existing analytical data, past site practices, and physical setting and processes.

3.5 COMPARABILITY

3.5.1 Definition

Comparability is an expression of the confidence with which one data set can be compared with another. Comparability can be related to precision and accuracy since these quantities are measures of data reliability.

3.5.2 Measures To Ensure Comparability of Field Data

Samples from the same media are considered comparable if the procedures for collecting the samples are complied with and if the units of measurement are the same.

3.5.3 Measures to Ensure Comparability of Laboratory Data

Comparability is assured through the use of a laboratory for this project that uses established and approved analytical methods, protocols, and a laboratory quality control program designed to

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Quality Assurance Objectives for Measurement

establish consistency in the performance of the analytical process. All data will be subjected to strict QA/QC procedures and reported in a consistent manner to allow for comparison across data sets.

3.6 SENSITIVITY

3.6.1 Definition

Sensitivity refers to a measurable concentration of an analyte which has an acceptable level of confidence.

3.6.2 Measures to Ensure Comparability of Laboratory Data

Sensitivity is measured through the determination of detection limits for each analytical method. Method detection limits (MDLs) are the lowest concentration of an analyte that can be measured with 99% confidence that the analyte concentration is greater than zero. Practical quantitation limits (PQLs) are levels above the MDLs at which the laboratory has demonstrated the quantitation of analytes. The sensitivity of the analytical methods is dependent upon whether the methods associated with this project have PQLs and MDLs at sufficiently low levels to adequately assess the project DQOs. Field sampling personnel, the analytical laboratory, the data validator and risk assessors (human health) will work together to ensure that PQLs are as low as feasible for the media being sampled and that sample analytical results will achieve data quality levels (DQLs) within the limits of the selected analytical method. The PQLs and MDLs are presented in **Tables 2A through 2E**. The PQLs and MDLs presented in the VOC table for soil are based on USEPA Method 5035 preparation procedure.

3.7 LEVEL OF QUALITY CONTROL EFFORT

Field blanks, trip blanks, method blanks, duplicates, and matrix spikes/matrix spike duplicates samples will be analyzed to assess the quality of the data resulting from the field sampling and analytical programs.

The following are the field and laboratory QA/QC measures used to evaluate data quality.

A field blank (or equipment blank) will be collected and submitted to the laboratory with the investigative samples and analyzed for the same parameters as the investigative samples. Field blanks consist of distilled or de-ionized water which is poured over cleaned sampling equipment in between sample collections. Field blanks are analyzed to check for procedural contamination

SECTION THREE

Quality Assurance Objectives for Measurement

at the site which may cause sample contamination. The minimum required is one per every ten samples or one per sampling day if less than ten samples are collected, unless dedicated sampling equipment is used to collect samples.

A trip blank must be included in each cooler which contains samples for VOC analysis and is analyzed by the laboratory for VOCs for all sites at which VOCs are one of the analytical parameters. The trip blank consists of organic-free water placed in one or more VOC vials, and is transported to the sampling site unopened, stored with the investigative samples, and kept closed until analyzed by the laboratory. Trip blanks are used to assess the potential for VOC contamination of samples due to constituent migration during sample shipment. One trip blank is required for each shipping container which contains samples collected for VOC analysis.

Method blanks are used to assess contamination resulting from the laboratory procedures. The laboratory must run a method (preparation) blank at the beginning of each analytical run for each day that the analysis is performed. If not all sample analyses are completed in one day, a minimum of one method blank per sample matrix per analytical method must be run at the beginning of each sample batch analyzed each day.

Field duplicates must be collected for each matrix sampled. Field duplicate samples are analyzed as a check of sampling and analytical reproducibility; laboratory duplicates provide an estimate of the reproducibility of measurement. The field duplicate will be analyzed for all parameters for which the investigative samples of that matrix are analyzed. The minimum number of field duplicates required is one per every ten samples or, if there are fewer than ten samples, one per matrix.

Matrix spikes (MSs) provide information about the effect of the sample matrix or digestion and measurement methodology. MSs for organic analyses will be performed in duplicate (MSD). The spike duplicate will be performed for inorganic analyses. MS or spike duplicate samples will be collected at a frequency of one for every twenty samples collected, or, if fewer than twenty samples per matrix, one for each matrix sampled. The MS/MSD and spike duplicate is an investigative sample which (for each applicable analytical parameter for that sample matrix) is spiked with target analytes for that analytical procedure, and analyzed with the other samples of that matrix. Samples chosen as MS/MSD and spike duplicates should be selected prior to the sampling event so that sufficient sample volume is acquired.

SECTION THREE

Quality Assurance Objectives for Measurement

Laboratory control samples (LCSs) are standard solutions that consist of known concentrations of the target analytes spiked into laboratory organic-free distilled water or clean sand. They are prepared or purchased from a source independent from the calibration standards to provide an independent verification of the calibration procedure. They are spiked with all target analytes for each analysis. These QC samples are then prepared and analyzed following the same procedures employed for environmental sample analysis to assess method accuracy independently of sample matrix effects. The laboratory will prepare and analyze an LCS with each group of twenty samples of similar matrix that are extracted, digested, or analyzed at the same time (within same 12-hr period) for gas chromatograph/mass spectrometer (GC/MS) analysis. Percent recoveries will be evaluated using laboratory established control limits to assess the efficiency of preparation and analysis method independent of environmental sample matrix effects.

Upon initiation of an analytical run, the laboratory must perform calibration procedures as instructed by the analytical methods used. During the length of the run, calibration verifications must be performed at the frequency specified to verify the initial calibration.

Surrogates must be added to all samples for organic analysis. Surrogate recovery will be used to assess accuracy of organic analyses.

Control limits are the maximum and/or minimum values which define a range for a specific parameter, as outlined within each analytical procedure, at which sample results are considered to satisfactorily meet quality control criteria. When the parameter falls outside that range, the procedure is considered to be out-of-control. Whenever the analytical procedure is or becomes out-of-control, corrective action must be taken to bring the analysis back into control. The corrective action must include:

1. Finding the cause of the problem
2. Correcting the problem
3. Demonstrating the problem has been corrected by reanalyzing appropriate laboratory reference samples
4. Repeating the analysis of any investigative samples that may have been affected by the control problem.

SECTION THREE

Quality Assurance Objectives for Measurement

Exceptions will be made on a case-specific basis. Documentation must include evidence that a good-faith effort was made to meet the control limit; this may include two attempts to analyze the sample.

The following are the field equipment QC efforts for the project:

Field analytical equipment will be calibrated prior to each day's use and more frequently if required. The calibration procedures will conform to manufacturer's standard instructions. This calibration will ensure that the equipment is functioning within the allowable tolerances established by the manufacturer and required by the project. Records of all instrument calibration will be maintained by the URS PM and will be subject to audit by the URS QAO. Copies of all of the instrument manuals will be maintained on-site by the URS Field Team Leader.

The QC effort for photoionization detector (PID) measurements will include calibration checks using calibration gas which will be performed immediately prior to each day's use and more frequently if required.

The QC effort for explosimeter measurements will be maintained by using a simultaneous zero calibration and span calibration procedure maintained in accordance with the manufacturer's annual recommendations.

The QC effort for real-time aerosol monitor (RAM) measurements will be maintained by using an internal calibration method installed by the factory when the instrument is manufactured. The factory calibrates the instrument to the standard ISO 12103-1, A1 test dust. The calibration data is stored internally and cannot be accessed. This standard test dust is used because of its wide particle size distribution which makes the internal calibration representative of an average of most types of ambient aerosol that may be encountered.

SECTION FOUR

Sample Procedures

The following sampling procedures and practices that will be used in conducting this work are presented in the FSP and in the Health and Safety Plan:

- Soil sampling
- Sample custody procedures
- Decontamination procedures.

The sample identification system will involve the following:

- Soil samples will be labeled SOIL-WGK-S1-__FT where “SOIL” denotes a soil sample, “WGK” is the site designation, “S1” is the sequentially numbered sampling station, and “__FT” indicates the sample depth range (e.g., 0-2).
- “MS/MSD” or “DUP” at the end of a sample identification will indicate a matrix spike/matrix spike duplicate/spike duplicate or a duplicate sample, respectively.

Table 3 lists the sample volumes suggested for soil samples collected for this project, as well as the holding times, the proper containers, and the required preservation. The QC samples to be collected including field duplicates, field blanks, MS/MSDs, and spike duplicates are also presented in the **Table 3**.

Care should be taken that sufficient sample volume is provided for all necessary analyses to be performed. This applies to field blanks, field duplicates, and MS/MSD/spike duplicate samples as well as for investigative samples. This is most easily accomplished by specifying that samples are collected in specific sizes and types of containers which provide sufficient volume (and meet other necessary criteria) for the particular types of analyses that will be performed. Samples designated for use as the MS/MSD require additional volume for organic analysis.

SECTION FIVE

Custody Procedures

Chain-of-custody procedures will be instituted and followed throughout the investigation. Custody is one of several factors necessary for the admissibility of environmental data as evidence in a court of law. Custody procedures help to satisfy the two major requirements for admissibility: relevance and authenticity. Sample custody is addressed in three parts: field sample collection, laboratory activities, and final evidence files. Final evidence files, including all originals of laboratory reports, are maintained under document control in a secure area. Samples are physical evidence and will be handled according to strict chain-of-custody protocols. The URS QAO must be prepared to produce documentation that traces the samples from the field to the laboratory. The USEPA has defined custody of evidence as follows:

- In actual possession
- In view after being in physical possession
- In a locked location
- In a designated, secure, restricted area.

5.1 FIELD CUSTODY PROCEDURES

The field samplers are personally responsible for the care and custody of the sample until transferred. In the field sampler's individual bound field notebook, samplers will note, with permanent ink, meteorological data, equipment employed for sample collection, calculations, information regarding collection of QA/QC samples, and any observations. All entries will be signed and dated, and any entry which is to be deleted shall use a single cross-out which is signed and dated. The following types of information will be recorded in the field notebook by the field sampling team:

- Sample number
- Project identification
- Sampling location
- Required analysis
- Date and time of sample collection
- Type and matrix of sample
- Sampling technique

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Custody Procedures

- Preservation used if applicable
- Sampling conditions
- Observations
- Initials of the sampler.

A sample label, which is shown in **Figure 1**, will each be attached to each investigative or QC sample and the sample placed in a shipping container. A sample custody seal (**Figure 2**) will be applied to the coolers. The following will be recorded with permanent ink on sample labels and on chain-of-custody records by the field sampling team:

- Project name and number
- Sample number identification
- Initials of sampler
- Sampling location (if not already encoded in the sample number)
- Required analysis
- Date and time of sample collection
- Space for laboratory sample number (only on the sample tag)
- Preservative used, if applicable.

The sample identification system to be used in the field is described in Chapter 4 of this QAPP.

The field sampling team will send the coolers to the designated laboratory. Samples will not be sent to another laboratory without the permission of USEPA Region V.

The laboratory will assign a number for each sample upon receipt.

A sample chain-of-custody form will be completed for each shipment to the analytical laboratory. The chain-of-custody will include the following information:

- Project identification and number
- Sample description/location
- Required analysis

SECTION FIVE

Custody Procedures

- Date and time of sample collection
- Type and matrix of sample
- Number of sample containers
- Analysis requested/comments
- Sampler signature/date/time
- Air bill number.

A chain-of-custody document providing all information, signatures, dates, and other information, as required on the example chain-of-custody form in **Figure 3**, will be completed by the field sampler and provided for each sample cooler. When transferring the possession of samples, the individuals relinquishing and receiving will sign, date, and note the time on the chain-of-custody. The field sampler will sign the chain-of-custody record when relinquishing custody, and include the original form in an air-tight plastic bag in the sample cooler with the associated samples. Sampling containers will be packed to help prevent breakage and cross-contamination. Samples will be shipped in coolers, each containing a chain-of-custody and ice and ice packs to maintain inside temperature at approximately 4°C. Sample coolers will then be sealed between the lid and sides of the cooler with two custody seals prior to shipment. The custody seals will consist of adhesive-backed tape that easily rips if it is disturbed. Samples will be shipped to the laboratory by common overnight carrier or will be delivered by URS. Samples will be packed following applicable DOT requirements.

Samples will remain in the custody of the sampler until transfer of custody is completed. Transfer consists of:

- Delivery of samples to the laboratory sample custodian
- Signature of the laboratory sample custodian on the chain-of-custody document as receiving the samples and signature of sampler as relinquishing the samples.

If a carrier is used to take samples between the sampler and the laboratory, a copy of the air bill must be attached to the chain-of-custody to maintain proof of custody, and the air bill number must be written on the chain-of-custody.

SECTION FIVE

Custody Procedures

5.2 LABORATORY CUSTODY PROCEDURES

Laboratory custody procedures begin when the laboratory receives the samples. When the samples arrive at the laboratory, either the mail room custodian or the sample custodian (identified in Chapter 2) will sign the vendor's air bill or bill of lading (unless hand-delivered) and the chain-of-custody. The sample custodian's duties and responsibilities upon sample receipt will be to:

- Document receipt of samples.
- Inspect sample shipping containers for the presence or absence of custody seals (only if shipped via overnight courier) and for container integrity.
- Check the cooler temperature and record on the chain-of-custody. If the cooler temperature is greater than 10°C, the URS QAO will be contacted.
- Sign and date the appropriate forms or documents, verify and record the agreement or disagreement of information on sample documents, and, if there are discrepancies, record the problem and notify the Laboratory QAO.
- Log sample information into the laboratory sample tracking system, including:
 - date and time of sample receipt
 - project number
 - field sample number
 - laboratory sample number (assigned during log-in procedure)
 - sample matrix
 - sample parameters
 - storage location
 - log-in person's initials
- Label sample with a unique, sequential laboratory sample number.
- Place samples in the walk-in cooler, or sample storage area which is a secure, limited-access storage. The samples collected for volatile analysis will be stored in a separate refrigerator.

SECTION FIVE

Custody Procedures

At the laboratory, the analyst will be required to log samples and extracts in and out of storage as the analysis proceeds. An example of the laboratory internal chain-of-custody form is provided as **Figure 4**. Samples and extracts will be returned to secure storage at the close of business. Written records will be kept of each time the sample or extract changes hands. Care must be exercised to properly complete, date, and sign items needed to generate data.

The laboratory must use the following procedures:

- Samples will be handled by the minimum number of people possible.
- The laboratory will set aside a secured sample storage area consisting of a clean, dry, refrigerated, isolated room, which is capable of being locked.
- A specific person will be designated sample custodian. Incoming samples must be received by the custodian who will indicate receipt by signing the chain-of-custody form.
- The custodian will ensure that samples which are heat-sensitive, light-sensitive, radioactive, or which require special handling in other ways, are properly stored and maintained prior to analysis.
- The analytical area will be restricted to authorized personnel only.
- After sample analyses are complete, the laboratory may discard samples one month after the date on the final report. Analytical data is to be kept secured and released to authorized personnel only.

5.3 FINAL EVIDENCE FILE CHAIN-OF-CUSTODY PROCEDURES

The final evidence file will be the central repository for documents which constitute evidence relevant to sampling and analysis activities as described in this QAPP. URS is the custodian of the evidence file and maintains the contents of evidence files for the site, including relevant records, logs, field notebooks, pictures, subcontractor reports, and data reviews.

Copies of the following will be stored by the laboratory for incorporation into the sample file, if requested; the Laboratory OM will be responsible for final evidence documentation assembly:

- Documentation of the preparation and analysis of samples, including copies of the analysts' notebooks

SECTION FIVE

Custody Procedures

- Bench sheets, graphs, computer printouts, chromatograms, and mass spectra, as applicable.
- Copies of QA/QC data.
- Instrument logs showing the date, time, and identity of the analyst.
- Analytical tracking forms that records the date, time, and identity of the analyst for each step of the sample preparation, extraction, and analysis.

Upon completion of the analyses, the URS QAO will begin assimilating the field and laboratory notes. In this way, the file for the samples will be generated. The final file for the sample will consist of the following:

- Laboratory data packages, including summary and raw data from the analysis of environmental and QC samples, chromatograms, mass spectra, calibration data, work sheets, and sample preparation logs.
- Chain-of-custody records.
- Data validation reports.

The following documentation will supplement the chain-of-custody records:

- Field notebooks and data
- Field collection report
- Pictures and drawings
- Progress and QA reports
- Contractor and subcontractor reports
- Correspondence.

The evidence file must be maintained in a secured, limited access area until submittals for the project have been reviewed and approved, and for a minimum of six years past the submittal date of the final report.

SECTION SIX

Calibration Procedures and Frequency

Calibration is a reproducible reference point in which all sample measurements can be correlated. A sound calibration program shall include provisions for documentation of frequency, conditions, standards, and records reflecting the calibration history of a measurement system. The accuracy of the calibration standard is important because all data will be in reference to the standards used.

Proper calibration of laboratory analytical instrumentation and field instrumentation is essential for the generation of reliable data which meets the project's DQOs. Analytical instrument calibration is monitored through the use of control limits which are established for individual analytical methods. Calibration procedures to be followed are specified, in detail. These procedures specify the type of calibration, calibration materials to be used, range of calibration, and frequency of calibration. For field analyses, calibrations must be performed and documented on the instrumentation used.

6.1 FIELD EQUIPMENT CALIBRATION

Field equipment that will be used to collect data on organic vapors, on-site dust concentrations, and explosive atmospheres will be calibrated in such a manner that accuracy and reproducibility of results are consistent with the manufacturer's specifications.

Field instruments to be used that require calibration include, but are not limited to, the following:

- HNu® PL-101, DL-101 PID, or Photovac MicroTIP® detector (or equivalent)
- Neotronics Mini Gas 4® Portable 4-in-1 Multi-Gas Monitor (explosimeter) (or equivalent)
- Dusttrak® Model 8520 RAM or equal (or equivalent).

Equipment to be used for the field sampling will be examined to confirm that it is in good operating condition. This includes checking the manufacturer's operating manual and the instructions for each instrument to confirm that the maintenance requirements are being observed. Field notes from previous sampling trips will be reviewed so that the notations on any prior equipment problems are not overlooked, and all necessary repairs to equipment have been carried out. Readily available spare parts will be maintained at the field office.

In general, instruments will be calibrated prior to each day's use and will be recalibrated as

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Calibration Procedures and Frequency

required. Where applicable, the linearity of the instrument will be checked by using a two-point calibration with reference standards bracketing the expected measurement. Instrument-specific operation manuals will be consulted if further detail is required. All calibration procedures performed will be documented in the field logbook.

Copies of the manufacturer's operations manuals for all field instruments to be used will be kept on-site during the field efforts. These manuals will be used for all calibration and operation activities.

6.2 LABORATORY EQUIPMENT CALIBRATION

The laboratory will be responsible for proper calibration and maintenance of laboratory analytical equipment. Calibration procedures are presented in the analytical methods and the laboratory SOPs. **Tables 4A** through **4F** present the specific calibration criteria and the conditions that will require recalibration for each method. Calibration procedures for a specific laboratory instrument will consist of initial calibration, initial calibration verification, and continuing calibration verification. The SOP for each analysis listed in **Table 5**, describes the calibration procedures, their frequency, acceptance criteria, and the conditions that will require recalibration. In all cases, the initial calibration will be verified using an independently prepared calibration verification solution. The laboratory maintains a sample logbook for each instrument which will contain the following information: instrument identification, date of calibration, analyst, calibration solutions, and the samples associated with the calibrations.

The USEPA calibration procedures and frequencies are specified in the USEPA organic and inorganic methods listed in **Table 1**.

6.3 STANDARDS AND SOLUTIONS

The use of standard materials of a known purity and quality is necessary for the generation of reproducible data. The laboratory will monitor the use of laboratory materials including solutions, standards, and reagents. Standards and standard solutions are obtained from the USEPA or commercial vendors. Certificates of analysis are included with each standard by the vendor.

Standards and standard solutions are verified prior to use. This verification may be in the form of a certification from the supplier. Standards may also be verified by comparison to a standard curve or another standard from a separate source. Standards are routinely checked for signs of

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Calibration Procedures and Frequency

deterioration, including unusual volume changes, discoloration, formation of precipitates, or changes in analyte response.

Solvent materials are also verified prior to use. Each new lot of solvent is analyzed to verify the absence of interfering constituents. Reagent and method blanks are routinely analyzed to evaluate possible laboratory-based contamination of samples.

6.4 RECORDS

A records book will be kept for standards and will include the following information:

- Material name
- Control or lot number
- Purity and/or concentration
- Supplier/manufacturer
- Receipt/preparation date
- Recipient's/preparer's name
- Expiration date.

These records will be checked periodically as part of the laboratory internal laboratory controls review.

6.5 CALIBRATION RECORDS

A bound notebook will be kept with each instrument that requires calibration. The notebook will contain a record of activities associated with QA monitoring and instrument repairs. These records will be checked during periodic equipment review and internal and external QA/QC audits.

SECTION SEVEN

Analytical Procedures

Soil samples collected for this project will be analyzed by Severn-Trent Laboratories located in Savannah, Georgia and Sacramento, California. The specific methods listed in **Table 1** and SOPs that will be utilized by the laboratories for sample analysis are presented in **Table 5**. The individual analytes to be tested for each method are presented in **Tables 2A** through **2E**. The analytes for each method were selected based on the Target Analyte List (TAL) for metals and the Target Compound List (TCL) for VOCs, SVOCs and Pesticides. Some analyte groups have been added to these lists based on historical data (e.g., herbicides, dioxins and PCBs). **Table 3** presents the specific QC samples to be taken for each analysis on a matrix specific basis.

7.1 FIELD ANALYTICAL PROCEDURES

The standardization and QA information for field measurements of organic vapors, on-site dust concentrations and potentially explosive atmospheres are described in Chapter 6 of this QAPP. A copy of the Health and Safety Plan and FSP have been submitted with the QAPP to expedite review and approval of these methods. Where appropriate, the methods to be used for these measurements are listed in **Table 1**.

7.2 LABORATORY ANALYTICAL PROCEDURES

For this QAPP, Severn Trent Laboratories will follow USEPA Methods listed in **Table 1** and the laboratories SOPs listed in **Table 5**.

The accuracy and precision of the analytical data generated by the laboratory will be determined through the analysis of duplicate samples, spiked samples, reference standard samples, laboratory control samples, and field and laboratory blank samples analyzed along with each set of environmental samples, where applicable.

Interferences will be identified and documented. When matrix interferences are noted during sample analysis, actions will be taken by the laboratory to achieve the specified detection limits. Samples may be diluted only if target or nontarget analytes generate responses in excess of the linear range of the instrument. The Laboratory QAO will document in the case narrative that the laboratory demonstrates good analytical practices in order to achieve the specified detection limits.

Standards and reference materials will be analyzed to determine analyte concentrations for comparison with expected concentrations to provide a measure of accuracy of the methods. For

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Analytical Procedures

organic analyses, the accuracy of the method will be determined by spiking the sample matrix with analytes and surrogates. Percent recoveries of the spikes will be calculated and compared with control limits. A measure of precision will be obtained through the RPD between matrix spikes and matrix spike duplicates. Sampling precision will be evaluated based on the RPD of duplicate field samples. RPDs will be compared to established control limits.

The generated data will be input into the laboratory's database management system. Complete descriptions of analytical procedures to be used in the laboratory are described in the SOPs and in the laboratory's Quality Assurance Manual (QAM) as listed in **Table 5**.

7.2.1 List of Project Target Compounds and Laboratory Detection Limits

Tables 2A through **2E** list the project target compounds, laboratory PQLs, and MDLs for samples to be used as reference during this investigation. Actual reporting limits may be higher in some samples, for example due to dilutions caused by matrix interference or high concentrations of target analytes.

7.2.2 List of Associated QC Samples

Section 3.7 of this QAPP and **Table 3** contain a listing of the associated QC samples for analytes and matrices.

SECTION EIGHT

Internal Quality Control Checks

The overall effectiveness of a quality control program depends upon operating in the field and laboratory according to a program that systematically ensures the precision and accuracy of analyses by detecting errors and preventing their recurrence or measuring the degree of error inherent in the methods applied. This section describes specific quality control checks to be addressed for both field and laboratory analyses in order to comply with the requirements of the FSP.

8.1 FIELD QUALITY CONTROL CHECKS

QC procedures for organic vapors, on-site dust concentrations and potentially explosive atmosphere will include calibrating the instruments as described in Chapter 6 of this QAPP, measuring duplicate samples, and checking the reproducibility of the measurements by taking multiple readings on a single sample or reference standard. The QC information for field equipment is stated in Chapter 6 of this QAPP. Section 3.7 of this QAPP discusses the QC samples (including trip blank, equipment blank, MS/MSD, spike duplicate, and field duplicate) that will be collected during the field investigation. **Table 3** lists the environmental and corresponding QC samples to be collected by analyses and matrix type.

Field sampling crews will be under direct supervision of the field sampling leader. Bound notebooks and appropriate data sheets will be used to document the collection of samples and data so that an individual sample or data set can be traced back to its point of origin, sampler, and type of sampling equipment. Sampling will be performed according to the methods provided in the FSP and this QAPP.

Assessment of field sampling precision and bias will be made by collecting field duplicates and field blanks for laboratory analysis.

8.2 LABORATORY QUALITY CONTROL CHECKS

Tables 4A through **4F** summarize the laboratory QC requirements, frequency, control limits, and laboratory corrective actions for each analytical method. In addition, the specific SOPs, as listed in **Table 5**, provide a description of the specific QC requirements.

All data obtained will be properly recorded. The data package will include a full deliverable package capable of allowing the recipient to reconstruct QC information and compare it to QC criteria, and perform data validation. Samples analyzed in nonconformance with the QC criteria

SECTION EIGHT

Internal Quality Control Checks

will be reanalyzed by the laboratory.

A brief description of laboratory QA/QC analyses for organics and inorganics is contained in the following subsections.

8.2.1 Calibration

Compliance requirements for satisfactory instrument calibration are established to verify that the instrument is capable of producing acceptable quantitative data. Initial calibration demonstrates that the instrument is capable of acceptable performance at the beginning of analysis, and calibration verification and performance checks document satisfactory maintenance and adjustment of the instrument on a day-to-day basis.

8.2.2 Blanks

Several types of blanks will be analyzed by the laboratory. Corrective action procedures will be implemented and documented for blank analyses if target compounds are detected at concentrations greater than the acceptable criteria. The criteria for evaluation of blanks apply to any blank associated with a group of samples. If problems with a blank exist, data associated with the project must be carefully evaluated to establish whether or not there is an inherent variability in the data for the project, or if the problem is an isolated occurrence not affecting other data.

A reagent blank consists of organic-free distilled water and any reagents added to a sample during analysis only, or straight solvent. This type of sample is analyzed to evaluate whether contamination is occurring during the analysis of the sample. A reagent blank is usually analyzed following highly contaminated samples to assess the potential for cross-contamination during analysis.

A method blank is organic-free water which undergoes the preparation procedures applied to a sample. These samples are analyzed to examine whether sample preparation and analysis techniques result in sample contamination. The laboratory will prepare and analyze a method blank with each group of twenty samples of similar matrix that are analyzed at the same time or one method blank per each 12-hour analytical sequence for GC/MS analysis.

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Internal Quality Control Checks

Field and trip blanks will also be collected and submitted for laboratory analysis, where appropriate. Field and trip blanks will be handled in the same manner as environmental samples. Field and trip blanks are analyzed to assess contamination introduced during field sampling procedures and sample shipment, respectively.

8.2.3 Internal Standards Performance

Internal standards, which are compounds not found in environmental samples, will be spiked into blanks, samples, MS/MSDs, and LCSs at the time of sample preparation. Internal standards for polychlorinated dibenzodioxin (PCDD) and polychlorinated dibenzofuran (PCDF) analyses are used to quantitate target compounds and to correct for variability of sample preparation, cleanup, and analysis with respect to individual sample matrices. Internal standards must meet retention time and performance criteria specified in the analytical method or the sample will be reanalyzed.

8.2.4 Recovery Standard

Recovery standards consist of two labeled PCDDs and PCDFs which are spiked into environmental samples, blanks, and QC samples prior to sample injection for PCDF and PCDD analyses. Recovery standards are used to monitor instrument performance by evaluating retention time shifts and are used to quantify results of internal standards.

8.2.5 Surrogate Recovery

Accuracy and matrix biases for individual samples are monitored for organic analyses using surrogate additions. Surrogates are compounds similar in nature to the target analytes which are spiked into environmental samples, blanks, and quality control samples prior to sample preparation for organic analyses. The evaluation of the results of these surrogate spikes is not necessarily straightforward. The sample itself may produce effects due to such factors as interferences and high concentrations of analytes. Since the effects of the sample matrix are frequently outside the control of the laboratory and may present relatively unique problems, the review and validation of data based on specific sample results is frequently subjective.

SECTION EIGHT

Internal Quality Control Checks

8.2.6 Laboratory Control Sample Analyses

LCSs are standard solutions that consist of known concentrations of the target analytes spiked into laboratory organic-free distilled water or clean sand. They are prepared or purchased from a certified manufacturer from a source independent from the calibration standards to provide an independent verification of the calibration procedure. They are spiked with all target analytes. These QC samples are then prepared and analyzed following the same procedures employed for environmental sample analysis to assess method accuracy independently of sample matrix effects. The laboratory will prepare and analyze an LCS with each group of twenty samples of similar matrix that are analyzed at the same time or each 12-hour analytical sequence period for GC/MS analysis. Percent-recoveries will be compared to laboratory control limits to assess the efficiency of preparation and analysis method independent of environmental sample matrix effects.

8.2.7 MS/MSD/Spike Duplicate Samples

MS/MSD and spike duplicate analyses will be performed on environmental samples at a frequency of one per sample matrix and every twenty samples of similar matrix. Whenever possible, MS/MSD and spike duplicate samples will be prepared and analyzed within the same batch as the environmental samples. MS/MSD and spike duplicate samples will be spiked at the laboratory with all target analytes. MS/MSD and spike duplicate data are generated to determine long-term precision and accuracy of the analytical method with respect to sample matrices.

8.2.8 Laboratory Duplicate or Matrix Spike Duplicate Samples

Laboratory duplicate or MSD analyses will be performed on environmental samples at a frequency of one per sample matrix and every twenty samples of similar matrix for inorganic analyses. Whenever possible, laboratory duplicate or MSD samples will be prepared and analyzed within the same batch as the environmental samples. Laboratory duplicate or MSD data are generated to determine long-term precision of the analytical method with respect to sample matrices.

8.2.9 Compound Identification and Quantitation

The objective of the qualitative criteria is to minimize the number of erroneous identifications of compounds. An erroneous identification can either be a false positive (reporting a compound present when it is not) or a false negative (not reporting a compound that is present). The

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identification criteria can be applied much more easily in detecting false positives than false negatives. Negatives, or non-detected compounds, on the other hand represent an absence of data and are, therefore, much more difficult to assess. The objective for quantitative requirements is to maximize the accuracy of data and sensitivity of the instrument. Samples will be analyzed undiluted when technically feasible (due to carryover or instrument contamination) to maximize sensitivity and to meet QAPP guidance criteria. Samples must be reanalyzed at the appropriate dilution when concentrations exceed the linear calibration range to maximize accuracy.

8.2.10 Control Limits

Laboratory control limits are established separately for each matrix type for each type of analysis. Laboratory control limits can be considered action limits. These limits are defined as \pm three standard deviations of the mean and correspond to 99.7% confidence limits of a normal distribution curve. The laboratory will establish control limits for each analyte of concern using a minimum of twenty data points. Laboratory control limits may change since limits are minimally updated on a yearly basis with the addition of new data points.

The laboratory control limits used to assess data for this program will be summarized by the laboratory in the analytical report.

SECTION NINE

Data Reduction, Validation, Reporting, and Data Management

For data to be scientifically valid, legally defensible, and comparable, valid procedures must be used to prepare these data. The following describes the data reduction, validation, and reporting procedures to be used for the Laboratory data.

Data reduction is the process of converting raw analytical data to final results in proper reporting units. Data reporting is the detailed description of the data deliverables used to completely document the analysis, calibration, quality control measures, and calculations. Data validation is the process of qualifying analytical/measurement data on the performance of the field and laboratory quality control measures incorporated into the sampling and analysis procedures.

Specific laboratory procedures and instrumentation can be found in the QAM and/or SOPs listed in **Table 5**. The data production and reporting procedures described below will be employed at the laboratory.

All data generated through field activities and analyzed by the laboratory shall be reduced by the laboratory, reported to URS, validated, and then reported to USEPA Region V.

9.1 DATA REDUCTION

9.1.1 Field Data Reduction Procedures

Field data reduction procedures will be minimal in scope compared to those implemented in the laboratory. Only direct reading instrumentation will be employed in the field. The use of PIDs, RAMs and explosimeters will generate some measurements directly from the meters following calibration by the respective manufacturer's recommendations. Such data will be written into field notebooks immediately after measurements are taken. If errors are made, results will be legibly crossed out, initialed, and dated by the field member, and corrected in a space adjacent to the original entry. Later, when the results forms are filled out, the URS Field Team Leader will proof the forms to assess whether transcription errors have been made.

9.1.2 Laboratory Data Reduction Procedures

Data reduction consists of manual and computer data reduction procedures and calculations. Computer data reduction procedures and calculations will be checked manually by the laboratory to verify that compound identification and quantitation adhere to method requirements. The laboratory will be responsible for maintaining a listing of computer-based data reduction

SECTION NINE

Data Reduction, Validation, Reporting, and Data Management

programs which it uses for data reduction. Sample preparation or extraction logs will be used to document sample preparation information (for example, preparation weights, volumes, and reagents). Instrument injection logs or bench sheets will also be maintained for each instrument. The equations that will be used in reducing data are those listed in the USEPA methods. Analytical results for soil samples shall be calculated and reported on a dry weight basis.

QC data will be compared to the method acceptance criteria. Data considered to be acceptable will be entered into the laboratory computer system. Data summaries will be sent to the Laboratory QAO for review. Unacceptable data shall be appropriately qualified in the project report. Case narratives will be prepared which will include information concerning data that fell outside acceptance limits, and any other anomalous conditions encountered during sample analysis. After the Laboratory QAO or Laboratory PM approves these data, they are considered ready for data validation.

Qualitative identification and quantitation of organic analytes will be performed by experienced analysts in accordance with analytical method requirements.

Analytical results are generally entered into the laboratory computer system by the analyst, independently reviewed by another analyst or supervisor experienced in the method, and approved by the Laboratory QAO or Laboratory PM. The following are requirements that are generally examined as part of this review:

- Initial calibration criteria were met. Standards in the calibration curve covered the expected concentration ranges of the samples
- Initial and continuing calibrations met the acceptance criteria defined in the method standard procedure
- Sample results fell within the range of the standard curve
- For GC/MS methods requiring internal standards, retention times and area responses were evaluated against limits established by the daily calibration
- Method blanks were processed with each analytical batch and no detectable levels of contamination were identified (with the possible exception of common laboratory contaminants)

SECTION NINE

Data Reduction, Validation, Reporting, and Data Management

- MS/MSDs were performed at the required frequency and recoveries were within acceptable control limits
- Duplicate analyses were performed at the required frequency and results were within the advisory control limits
- LCS analyses were performed with each analytical batch and the results obtained were within control limits
- For organic compound analyses, surrogate spike recoveries were within control limits
- Compounds identified by GC/MS have been manually rechecked by comparison with the data system library for both target compounds and tentatively identified compounds. Retention times and ratios of fragmentation were verified
- Calculations have been accurately performed
- Reporting units are correct
- Data for the analysis provide a complete audit trail
- Reported detection limits comply with data quality indicator requirements.

The analyst's supervisor will check a minimum of 10% of the data back to raw data in the secondary review, (or as outlined in the laboratory QAPP). When required analyses on the samples in a project are complete, entered, and reviewed, a report will be generated.

The report will be forwarded to the Laboratory QAO for review. The report will then be reviewed for the following items (at a minimum):

- QC data will be reviewed to identify whether or not internal specification and contract requirements have been met
- Non-conformance reports, if any, will be reviewed for completion of corrective actions and their impact of results. Non-compliance and corrective action procedures will be documented in the case narrative in the final report.

The report requires the signature of the Laboratory QAO or Laboratory PM. Electronic data are copied onto computer tape, inventoried, and stored off-site in a secure facility, or within locked cabinets on-site. This data archive system is maintained minimally for ten years.

SECTION NINE

Data Reduction, Validation, Reporting, and Data Management

9.2 DATA VALIDATION

Data validation procedures shall be performed for both field and laboratory operations.

9.2.1 Procedures Used to Evaluate Field Data

Procedures to evaluate field data for this project primarily include checking for transcription errors on the part of field crew members and review of field notebooks. This task will be the responsibility of the URS Field Team Leader.

9.2.2 Procedures to Validate Laboratory Data

Data validation will be performed by URS in accordance with QA/QC criteria established in this QAPP and the analytical methods for 100% of the analytical data. A Level II validation will be performed for approximately 80% of the data, and a Level IV validation will be performed for approximately 20% of the data. Excursions from QA/QC criteria will be qualified based on guidance provided in the following documents or the most recent USEPA data validation guidelines:

- *USEPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review*. USEPA 540/R-00/006 (USEPA, 2001)
- *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*. USEPA 540/R-01/008 (USEPA, 2002)
- *USEPA Contract Laboratory Program National Functional Guidelines for Chlorinated Dioxin/Furan Data Review*. USEPA 540/R-02/003 (USEPA, 2002)

Herbicides will also be reviewed using guidance presented in National Functional Guidelines for Low Concentration Organic Review (USEPA 2001); however, since no specific criteria are presented in the guidance document, the data will be reviewed following the criteria established in Method 8151 and using the QC limits provided in this QAPP.

The analytical data from each method and matrix will be reviewed for the QC parameters as presented in the following section. Data validators will recalculate 20% of the laboratory sample calculations using raw data when verifying sample results. In addition, data validators will review 20% of the raw data to verify that compound identification was performed correctly and transcription errors are not present.

SECTION NINE

Data Reduction, Validation, Reporting, and Data Management

Data quality will be evaluated using method or laboratory control limits. Any control limits outside of the acceptable range shall be identified and reported. Sample data will be qualified based on excursions from method or laboratory control limits. Data not within control limits require corrective action by the laboratory. Data validators will check corrective actions and results of reanalysis and document these events in the validation report.

Minor deficiencies in the data generation process noted in the data validation will result in approximation of sample data. Approximation of a data point indicates uncertainty in the reported concentration of the chemical but not its assigned identity. Major deficiencies noted in the data, validation will result in the rejection of sample results. Rejected data would be considered unusable for quantitative or qualitative purposes. Data qualifiers may include the following:

- U Indicates that the compound was analyzed for, but was not detected. The sample quantitation limit is presented and adjusted for dilution and percent moisture. This qualifier is also used to signify that the detection limit of an analyte was raised as a result of analytes detected in laboratory and/or field blank samples.
- J Indicates that the detected sample result should be considered approximate based on excursions from QA/QC criteria.
- UJ Indicates that the detection limit for the analyte in this sample should be considered approximate based on excursions from QA/QC criteria.
- R Indicates that the previously reported detection limit or sample result has been rejected due to a major excursion from QA/QC criteria, for example percent recoveries of less than ten percent. The data should not be used for qualitative or quantitative purposes.

The following method specific QA/QC parameters will be evaluated (at a minimum) during the data validation, where applicable.

Analyses for VOCs and SVOCs (where applicable)

- Holding times, sample preservation, and percent solids
- Dilutions
- GC/MS tuning criteria (Level IV validation only)

SECTION NINE

Data Reduction, Validation, Reporting, and Data Management

- Initial and continuing calibration (Level IV validation only)
- Blank analysis
- Surrogate recovery
- MS/MSD analysis
- Field duplicate analysis
- Laboratory Control Sample (LCS) analysis
- Internal standards performance (Level IV validation only)
- Compound identification and quantitation (Level IV validation only)
- Reported detection limits
- System performance (Level IV validation only)
- Documentation completeness
- Overall assessment.

Analyses for pesticides, PCBs, and herbicides (where applicable):

- Holding times, sample preservation, and percent solids
- Dilutions
- GC performance (Level IV validation only)
- Analytical sequence (Level IV validation only)
- Initial and continuing calibration (Level IV validation only)
- Blank analysis
- Surrogate recovery
- MS/MSD analysis
- Field duplicate analysis
- LCS and MS blank analysis

SECTION NINE

Data Reduction, Validation, Reporting, and Data Management

- Retention time windows (Level IV validation only)
- Analyte identification, quantitation, and reported detection limits (Level IV validation only)
- Cleanup efficiency verification (Level IV validation only)
- Confirmation analysis (Level IV validation only)
- System performance (Level IV validation only)
- Documentation completeness
- Overall assessment.

Analysis for metals, mercury, and cyanide analyses (where applicable):

- Holding times, sample preservation, and percent solids
- Initial and continuing calibration (Level IV validation only)
- Blank analysis
- ICP interference check sample analysis (Level IV validation only)
- Spike duplicate analysis
- Field duplicate analysis LCS analysis
- Laboratory duplicate analysis
- ICP serial dilution analysis
- Furnace atomic absorption analysis (Level IV validation only)
- Verification of instrument parameters (Level IV validation only)
- Instrument detection limits
- Linear ranges (Level IV validation only)
- Analyte quantitation and reported detection limits (Level IV validation only)

SECTION NINE

Data Reduction, Validation, Reporting, and Data Management

- Documentation completeness
- Overall assessment.

Analysis for PCDDs and PCDFs analyses (where applicable):

- Holding times, sample preservation, and percent solids
- GC/MS tuning criteria (Level IV validation only)
- Column performance check standard analysis (Level IV validation only)
- Initial and continuing calibration (Level IV validation only)
- Blank analysis
- Internal standard criteria (Level IV validation only)
- Recovery standard criteria
- MS/MSD analysis
- Field duplicate analysis
- Compound identification and quantitation (Level IV validation only)
- Confirmation analysis (Level IV validation only)
- System performance (Level IV validation only)
- Documentation completeness
- Overall assessment.

The laboratories will be conducting analyses on samples in accordance with methods listed in **Table 1** and the laboratory's SOPs. Data generated by the laboratory will be computerized in a format organized to facilitate data review and evaluation. The computerized data set will include the data flags provided by Severn Trent Laboratories as well as the URS data validation results.

9.3 DATA REPORTING

Data reporting procedures shall be carried out for field and laboratory operations as indicated below.

SECTION NINE

Data Reduction, Validation, Reporting, and Data Management

9.3.1 Field Data Reporting

Field data reporting shall be conducted principally through the transmission of field logs containing tabulated results of all measurements made in the field, and documentation of all field calibration activities.

9.3.2 Laboratory Data Reporting

Data generated through field activities and analyzed by the laboratory shall be reduced by the laboratory, reported to URS, validated, then reported to USEPA Region V.

The Laboratory QAO, Laboratory OM, and Laboratory PM must perform a final review of the report summaries and case narratives to determine whether the report meets project requirements. The data packages provided by the laboratory will provide information so that a complete data validation can be performed on the data generated for this project.

The data report forms will be sequentially numbered. The laboratory will provide data reports that will include the following information (at a minimum):

- Case narrative report containing a summary of the samples collected, problems with sample receipt, methods employed, QA/QC excursions, and corrective action procedures
- Cross-reference table of sample identifications, laboratory sample identifications, sample matrix, analysis required and performed, date of sample collection, and date of sample receipt
- Case file containing documentation of cooler temperature and preservation checks performed
- Copies of completed chain-of-custody records
- Internal laboratory chain-of-custody records
- Analytical results of environmental samples, field duplicates, equipment blanks, and trip blanks with appropriate reporting limits
- Surrogate recovery results with appropriate laboratory control limits
- Batch-specific QA/QC results for laboratory method blanks, MS/MSDs, and LCSs with appropriate laboratory control limits

SECTION NINE

Data Reduction, Validation, Reporting, and Data Management

- GC/MS tuning data
- Initial and continuing calibration data summarized
- GC/MS internal standard summary forms
- Metals ICP quality control data summarized
- Summary table of MDLs and laboratory reporting limits
- Sample preparation bench sheets, digestion logs, and injection logs
- Appropriate raw instrument outputs for samples, blanks, QA/QC samples, and calibration standards
- Sample data
- Extraction log information
- Corrective action logs.

Tentatively identified compounds will not be reported for this project.

Standard preparation logs, use logs, and MDL studies will be made available by the laboratory upon request.

Review and cross-checking procedures will be as described in the laboratory SOPs and will ensure that the raw data and calculation results are properly, completely, and accurately transferred to the laboratory reporting format. In addition to the hardcopy version of the analytical data packages, the laboratory will provide electronic deliverables.

9.4 DATA MANAGEMENT

Data will be managed in a relational database management system (DBMS). Laboratory analytical data will be provided in electronic format for direct upload into the DBMS. Associated field data will be entered into the DBMS by hand, as appropriate.

The DBMS will then be used to provide custom queries and reports to support data validation, data analysis, and report preparation.

SECTION TEN

Performance and Systems Audits

The performance audit is an independent check to evaluate the quality of data being generated. The system audit is an on-site review and evaluation of the laboratories, instrumentation, quality control practices, data validation, and documentation procedures.

At the discretion of the URS Project Officer, performance and system audits of both field and laboratory activities will be conducted to verify that sampling and analyses are performed in accordance with the procedures established in the FSP and this QAPP. The audits of field and laboratory activities include two independent parts: internal and external audits.

If requested, the internal audits will be performed by the URS QAO. The external audits will be performed by USEPA Region V.

10.1 FIELD PERFORMANCE AND SYSTEM AUDITS

10.1.1 Internal Field Audits

Internal field audit responsibilities. Internal audits of field activities including sampling and field measurements will be conducted by the URS QAO.

Internal field audit frequency. These audits will verify that established procedures are being followed. Internal field audits will be conducted at least once at the beginning of the site sample collection activities and as required by the URS Project Officer thereafter.

Internal field audit procedures. The audits will include examination of field sampling records, field instrumentation operating records, sample collection, handling and packaging in compliance with the established procedures, maintenance of QA procedures, chain-of-custody, and other elements of the field program. Follow-up audits will be conducted to correct deficiencies and to verify that QA procedures are maintained throughout the FSP. The audits will involve review of field measurement records, instrumentation calibration records, and sample documentation. The areas of concern in a field audit include:

- Sampling procedures
- Decontamination of sampling equipment, if applicable
- Chain-of-custody procedures

SECTION TEN

Performance and Systems Audits

- SOPs
- Proper documentation in field notebooks.

10.1.2 External Field Audits

External field audit responsibilities. External field audits may be conducted by USEPA Region V.

External field audit frequency. External field audits may be conducted at any time during the field operations. These audits may or may not be announced and are at the discretion of USEPA Region V.

Overview of the external field audit process. External field audits will be conducted according to the field activity information presented in this QAPP.

10.2 LABORATORY SYSTEM AUDITS

10.2.1 Internal Laboratory Audits

Internal laboratory audit responsibilities. The internal laboratory audit will be conducted by the URS QAO.

Internal laboratory audit frequency. The internal laboratory system audits may be conducted on an annual basis.

Internal laboratory audit procedures. The internal laboratory system audits will include an examination of laboratory documentation on sample receiving, sample log-in, sample storage, chain-of-custody procedures, sample preparation, and analysis, instrumentation operating records, etc. The URS QAO will evaluate the analytical results to ensure the laboratory maintains acceptable QC performance.

10.2.2 External Laboratory Audits

External laboratory audit responsibilities. An external audit may be conducted by USEPA Region V.

External laboratory audit frequency. An external laboratory audit may be conducted at least once prior to the initiation of the sampling and analysis activities. These audits may or may not be announced and are at the discretion of USEPA Region V.

SECTION TEN

Performance and Systems Audits

Overview of the external laboratory audit process. External laboratory audits will include review of laboratory analytical procedures, laboratory on-site audits, and/or submission of performance evaluation samples to the laboratory for analysis.

The specific parameters to be evaluated (at a minimum) will include:

- Data comparability
- Calibration and quantitation
- QC execution
- Out-of-control events
- SOPs
- Sample management
- Record keeping
- Instrument calibration records
- Other analytical records
- QC records
- Corrective action reports
- Maintenance logs
- Data review
- Limits of detection
- QC limits
- Analytical methods.

SECTION ELEVEN

Preventive Maintenance

11.1 FIELD INSTRUMENT PREVENTIVE MAINTENANCE

The anticipated field equipment for this project includes a PID, a RAM, and an explosimeter. Specific preventive maintenance procedures to be followed for field equipment are those recommended by the manufacturer. Field instruments will be checked and calibrated daily before use. Calibration checks will be documented in the field notebooks. Critical spare parts such as batteries will be kept on-site to reduce downtime.

11.2 LABORATORY INSTRUMENT PREVENTIVE MAINTENANCE

As part of their QA/QC programs, routine preventive maintenance programs are conducted by Severn Trent Laboratories to minimize the occurrence of instrument failure and other system malfunctions. Severn Trent Laboratories perform routine scheduled maintenance and coordinate with the vendor for the repair of all instruments. Laboratory instruments are maintained in accordance with manufacturer's specifications and the requirements of the specific method employed. This maintenance is carried out on a regular, scheduled basis, and is documented in the laboratory instrument maintenance logbook for each instrument. Emergency repair or scheduled manufacturer's maintenance is provided under a repair and maintenance contract with factory representatives.

SECTION TWELVE

Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness

The procedures to assess the quality of data generated in the laboratory may include, but not be limited to, the following:

- Determination of analytical precision per method
- Determination of analytical accuracy per method
- Determination of analytical completeness.

The quality of data will be determined through evaluation of the appropriate QC measurements according to the specific analytical method used.

Precision and accuracy will be assessed utilizing method limits or control charts, where applicable. Control charts will consist of line graphs which provide a continuous graphic representation of the state of each analytical procedure. The standard deviation of the mean of the QC measurement is calculated, and the upper and lower warning limits are set at plus or minus two standard deviation units. The upper and lower control limits are set at plus or minus three standard deviation units. Acceptable data are realized when results fall between the lower and upper warning limits. If the QC value falls between the control limit and the warning limit, the analysis should be scrutinized as possibly out-of-control.

In general, the accuracy of the methods will be determined by spiking the sample matrix with the analyte and by analyzing reference materials with known concentrations, where applicable. The spiking levels will be selected to reflect the concentration range of interest. Percent recoveries of the spikes and reference materials will be calculated and compared to the established limits. The precision of the methods will be determined by the analysis of MS and laboratory and field duplicate samples. The precision will be evaluated by calculating the RPD between the duplicates. RPD calculations will be compared to the established limits.

The definitions and equations used for the assessment of data quality are discussed below.

12.1 ACCURACY ASSESSMENT

Accuracy is a measure of the nearness of an analytical result, or a set of results, to the true value. It is usually expressed in terms of error, bias, or percent recovery (%R).

Normally, the term accuracy is used synonymously with percent recovery. It describes either the

SECTION TWELVE

Specific Routine Procedures Used to Assess Data Precision, Accuracy, and Completeness

recovery of a synthetic standard of known value, or the recovery of known amount of analyte (spike) added to a sample of known value. The %R or accuracy can be calculated by using:

standards: $\%R = (\text{observed value}/\text{true value}) \times 100$

spikes: $\%R = (\text{conc. spike} + \text{sample conc.}) - (\text{sample conc.} \times 100)/\text{conc. spike}$

12.2 PRECISION ASSESSMENT

Precision refers to the agreement or reproducibility of a set of replicate results among themselves without assumption of any prior information as to the true result. It is usually expressed in terms of the percent difference (%D) or RPD. The %D is calculated by using:

$\%D = (\text{larger SR} - \text{smaller SR} \times 100) / \text{smaller SR}$

where SR is the sample result. The RPD is calculated by using:

$RPD = (|OSR - DSR| \times 100) / ((OSR + DSR) / 2)$

where OSR is the original sample result and DSR is the duplicate sample result.

12.3 COMPLETENESS ASSESSMENT

The completeness is the ratio of the number of valid sample results to the total number of samples analyzed for a specific matrix and/or analysis. It is calculated by using the following equation:

$\text{Completeness} = \text{number of valid measurements} / \text{number of measurements planned} \times 100.$

SECTION THIRTEEN

Corrective Action

Corrective action is the process of identifying, recommending, approving and implementing measures to counter unacceptable procedures or out-of-control performance which can affect data quality. Corrective action can occur during field activities, laboratory analyses, data validation, and data assessment. Corrective actions proposed and implemented will be documented in the regular quality assurance reports to management. Corrective action should only be implemented after approval by the URS PM, or the URS Field Team Leader. If immediate corrective action is required, approvals secured by telephone from the URS PM should be documented in an additional memorandum.

For noncompliance problems, a formal corrective action program will be developed and implemented at the time the problem is identified. The person who identifies the problem will be responsible for notifying the URS PM, who in turn will notify the URS PO. Implementation of a corrective action will be confirmed in writing through the same channels. Nonconformance with the established quality control procedures in this QAPP or FSP will be identified and corrected in accordance with this QAPP.

13.1 FIELD CORRECTIVE ACTION

Corrective action in the field could be needed when the sample network is changed (i.e., more or less samples, sampling location changes, and related modifications) or sampling procedures and/or field analytical procedures require modification due to unexpected conditions. Technical staff and project personnel will be responsible for reporting suspected technical or QA nonconformities or suspected deficiencies of any activity or issued document by reporting the situation to the URS Field Team Leader. The URS Field Team Leader will be responsible for assessing the suspected problems in consultation with the URS PM and assessing the potential for the situation to impact the quality of the data. If the situation warrants a reportable nonconformance requiring corrective action, then a nonconformance report will be initiated by the URS PM.

The URS PM will be responsible for seeing that corrective action for nonconformance are initiated by:

- Evaluating reported nonconformities
- Controlling additional work on nonconforming items
- Establishing disposition or action to be taken

SECTION THIRTEEN

Corrective Action

- Maintaining a log of nonconformities
- Verifying nonconformance reports and corrective actions taken
- Verifying nonconformance reports are included in the final site documentation in project files.

If appropriate, the URS Field Team Leader will verify that no additional work that is dependent on the nonconforming activity is performed until the corrective actions are completed. Corrective action for field measurements may include:

- Repeat the measurement to check the error
- Check for all proper adjustments for ambient conditions such as temperature
- Check the batteries
- Re-calibration
- Check the calibration
- Replace the instrument or measurement devices.
- Stop work (if necessary).

The URS Field Team Leader is responsible for site activities. In this role, the URS Field Team Leader at times is required to adjust the site programs to accommodate site-specific needs. When it becomes necessary to modify a program, the responsible person notifies the URS Field Team Leader of the anticipated change and implements the necessary changes after obtaining the approval of the URS Field Team Leader. The change in the program will be documented on the field change request (FCR) that will be signed by the initiators and the URS Field Team Leader. The FCR for each document will be numbered serially as required. The FCR shall be attached to the file copy of the affected document. The URS Field Team Leader must approve the change in writing or verbally prior to field implementation, if feasible. If unacceptable, the action taken during the period of deviation will be evaluated in order to ascertain the significance of any departure from program practices and action taken.

The URS Field Team Leader is responsible for the controlling, tracking, and implementing the identified changes. Reports on changes will be distributed to all affected parties, including USEPA Region V.

SECTION THIRTEEN

Corrective Action

Corrective action resulting from internal field audits will be implemented immediately if data may be adversely affected due to unapproved or improper use of approved methods. The URS QAO will identify deficiencies and recommend corrective action to the URS PM. Implementation of corrective actions will be performed by the URS Field Team Leader and the field team. Corrective action will be documented in the quality assurance report to the project management.

Corrective actions will be implemented and documented in the field notebook. No staff member will initiate corrective action without prior communication of findings through the proper channels. If corrective actions are insufficient, work may be stopped by USEPA Region V.

13.2 LABORATORY CORRECTIVE ACTION

Corrective action in the laboratory may occur prior to, during, and after initial analysis. A number of conditions, such as broken sample containers, multiple phases, low or high pH readings, or potentially high concentration samples may be identified during sample log-in or just prior to analysis. Following consultation with laboratory analysts and section leaders, it may be necessary for the Laboratory QAO to approve the implementation of corrective action. **Tables 4A through 4F** specify conditions during or after analysis that may automatically trigger corrective action or optional procedures. These conditions may include dilution of samples or automatic reinjection or reanalysis of samples.

Corrective actions are required whenever an out-of-control event or potential out-of-control event is noted. The investigative action taken is somewhat dependent on the analysis and the event.

Laboratory personnel are alerted that corrective actions may be necessary if:

- QC data are outside the acceptable windows for precision and accuracy
- Blanks contain target analytes above acceptable levels
- Undesirable trends are detected in spike recoveries or RPD between duplicates
- There are unusual changes in the detection limits
- Deficiencies are detected by the QA Department during internal or external audits or from the results of performance evaluation samples

SECTION THIRTEEN

Corrective Action

- Inquiries concerning data quality are received.

Corrective action procedures are often handled at the bench level by the analyst, who reviews the preparation or extraction procedure for possible errors, checks the instrument calibration, spike and calibration mixes, instrument sensitivity, etc. If the problem persists or cannot be identified, the matter is referred to the Laboratory OM, Laboratory PM, and Laboratory QAO for further investigation. Once resolved, full documentation of the corrective action procedure is filed with the QA department.

Tables 4A through 4F describe the quality control requirements and the corrective actions for each type of analysis required for this FSP.

These corrective actions are performed prior to release of the data from the laboratory. The corrective actions will be documented in both the laboratory corrective action log and the case narrative. If corrective action does not rectify the situation, the laboratory will contact the URS QAO.

13.3 CORRECTIVE ACTION DURING DATA VALIDATION AND DATA ASSESSMENT

The URS QAO and Laboratory QAO may identify the need for corrective action during either the data validation or data assessment. Potential types of corrective action may include resampling by the field team or reinjection or reanalysis of samples by the laboratory.

These actions are dependent upon the ability to mobilize the field team or whether the data to be collected are necessary to meet the required quality assurance objectives. When the URS QAO or Laboratory QAO identifies a corrective action situation, it is the URS PM who will be responsible for approving the implementation of corrective action, including resampling, during data assessment. Corrective actions of this type will be documented by the URS QAO and the Laboratory QAO.

SECTIONFOURTEEN

Quality Assurance Reports to Management

The deliverables associated with the tasks identified in the FSP and periodic progress reports will contain a separate QA section in which data quality information collected during the task is summarized. Those reports will be the responsibility of the URS PM and will include the URS QAO and Laboratory QAO report on the accuracy, precision, and completeness of the data as well as the results of the performance and system audits, and any corrective action needed or taken during the project.

14.1 CONTENTS OF PROJECT QA REPORTS

The QA reports will contain on a routine basis results of field and laboratory audits, information generated during the past month reflecting the achievement of specific data quality objectives, and a summary of corrective action that was implemented and its immediate results on the project. The status of the project with respect to the project schedule will be established. Whenever necessary, changes in key personnel and anticipated problems in the field or the laboratory for the coming month that could bear on data quality, along with proposed solutions, will be reported. Detailed references to QAPP modifications will also be highlighted. QA reports will be prepared in written format by the URS PM. In the event of an emergency, or in case it is essential to implement corrective action immediately, QA reports can be made by telephone to the appropriate individuals, as identified in the project organization section of this QAPP. However, these events and their resolution will be addressed thoroughly in the next issue of the monthly QA report.

14.2 FREQUENCY OF QA REPORTS

The QA reports will be prepared on a monthly basis. The reports will continue without interruption until the project has been completed.

14.3 INDIVIDUALS RECEIVING/REVIEWING QA REPORTS

Individuals identified in Chapter 2 of this QAPP will receive copies of the monthly QA reports.

SECTION FIFTEEN

References

- Solutia, 2000. Description of Current Conditions Report, August 1, 2000. Prepared by URS Corporation.
- U.S. Environmental Protection Agency (USEPA). 1980. *Interim Guidelines and Specifications for Preparing Quality Assurance Project Plans*, QAMS-005/80.
- U.S. Environmental Protection Agency (USEPA). 1993c. *Data Quality Objectives Process For Superfund, Interim Final Guidance*.
- U.S. Environmental Protection Agency (USEPA). 1994b *Requirements for Quality Assurance Project Plans for Environmental Data Operation* USEPA QA/R-5.
- U.S. Environmental Protection Agency (USEPA). 1996b. *Region V Model Quality Assurance Project Plan*, Revision 1.
- U.S. Environmental Protection Agency (USEPA). 2001. *USEPA Contract Laboratory Program National Functional Guidelines for Low Concentration Organic Data Review*, USEPA 540/R-00/006, Washington, D.C.
- U.S. Environmental Protection Agency (USEPA). 2002. *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, USEPA 540/R-01/008, Washington, D.C.
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Tables

TABLE 1
ANALYTICAL METHODS FOR PARAMETERS

Parameter	Sample Media	Analytical Method	References	Laboratory Performing Analysis
VOCs	soil	EPA Method 8260B	1	Severn Trent at Savannah, Georgia
SVOCs	soil	EPA Method 8270C	1	Severn Trent at Savannah, Georgia
Pesticides	soil	EPA Method 8081A	1	Severn Trent at Savannah, Georgia
Herbicides	soil	EPA Method 8151A	1	Severn Trent at Savannah, Georgia
PCBs	soil	EPA Method 680	2	Severn Trent at Savannah, Georgia
Dioxins	soil	EPA Method 8280A	1	Severn Trent at Sacramento, California
Metals	soil	EPA Method 6010B	1	Severn Trent at Savannah, Georgia

Notes:

VOCs indicate volatile organic compounds.

SVOCs indicate semivolatile organic compounds.

PCBs indicate polychlorinated biphenyls.

- 1 USEPA. 1996a. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods*, SW-846, 3rd Edition. Washington D.C.
- 2 USEPA. 1985. *Determination of Pesticides and PCBs in Water and Soil/Sediment by Gas Chromatography/Gas Spectrometry*, Physical and Chemical Methods Branch, Environmental Monitoring and Support Laboratory, Office of Research and Development, Cincinnati, Ohio.

TABLE 2A
LABORATORING CONTROL LIMITS AND DETECTION LIMITS



STL Savannah

8260 Table - Soil

Parameter	Method	Accuracy	Precision	MDL (ug/kg)	PQL (ug/kg)	DQL (ug/kg)
1,1,1-Trichloroethane	8260(5035)	41-134	≤54	0.33	5	1,200,000 (b)
1,1,2,2-Tetrachloroethane	8260(5035)	49-144	≤28	0.37	5	930 (a)
1,1,2-Trichloroethane	8260(5035)	34-148	≤27	0.4	5	1,800,000 (b)
1,1-Dichloroethane	8260(5035)	51-129	≤38	0.38	5	130,000 (b)
1,1-Dichloroethene (MS)	8260(5035)	40-164	≤46	0.4	5	300,000 (b)
1,2-Dichloroethenes (total)	8260(5035)	37-142	≤56	0.88	10	3,100,000 (b)
1,2-Dichloroethane	8260(5035)	49-136	≤25	0.3	5	700 (b)
1,2-Dichloropropane	8260(5035)	52-124	≤27	0.43	5	500 (b)
2-Butanone (MEK)	8260(5035)	45-154	≤39	1.1	25	27,000,000 (a)
2-Hexanone	8260(5035)	45-127	≤32	1.2	25	2,800,000 (a,c)
4-Methyl-2-pentanone (MIBK)	8260(5035)	34-159	≤37	0.56	25	2,800,000 (a)
Acetone	8260(5035)	43-154	≤28	5	50	100,000,000 (b)
Benzene (MS)	8260(5035)	49-142	≤42	0.4	5	1,600 (b)
Bromodichloromethane	8260(5035)	32-149	≤33	0.16	5	92,000 (b)
Bromoform	8260(5035)	41-138	≤24	0.36	5	100,000 (b)
Bromomethane	8260(5035)	23-173	≤79	1.2	10	3,900 (b)
Carbon disulfide	8260(5035)	40-135	≤68	0.41	5	9,000 (b)
Carbon tetrachloride	8260(5035)	40-135	≤59	0.17	5	640 (b)
Chlorobenzene (MS)	8260(5035)	66-135	≤34	0.19	5	1,300 (b)
Chloroethane	8260(5035)	30-135	≤51	0.71	10	6,500 (a)
Chloroform	8260(5035)	50-133	≤38	0.36	5	540 (b)
Chloromethane	8260(5035)	32-142	≤53	0.39	10	2,600 (a)
cis-1,3-Dichloropropene	8260(5035)	40-133	≤34	0.27	5	390 (b)
Dibromochloromethane	8260(5035)	47-135	≤22	0.16	5	1,300,000 (b)
Ethylbenzene	8260(5035)	51-135	≤44	0.13	5	58,000 (b)
Methylene chloride	8260(5035)	44-142	≤32	2.2	5	24,000 (b)
Styrene	8260(5035)	43-140	≤45	0.2	5	430,000 (b)
Tetrachloroethene	8260(5035)	71-146	≤44	0.26	5	20,000 (b)
Toluene (MS)	8260(5035)	38-158	≤32	0.34	5	42,000 (b)
trans-1,3-Dichloropropene	8260(5035)	45-131	≤50	0.2	5	390 (b)
Trichloroethene (MS)	8260(5035)	51-146	≤34	0.26	5	8,900 (b)
Vinyl chloride	8260(5035)	33-142	≤65	0.3	10	1,100 (b)
Xylenes (total)	8260(5035)	37-133	≤43	0.57	10	320,000 (b)
Isopropylbenzene	8260(5035ext)	38-148	≤39	3.8	5.0	2,000,000 (a)
Trichlorofluoromethane	8260(5035ext)	32-138	≤30	2.0	5.0	2,000,000 (a)
Surrogates						
Dibromofluoromethane	8260(5035)	58-142	NA	NA	NA	
Dibromofluoromethane	8260(5035ext)	58-142	NA	NA	NA	
p-Bromofluorobenzene	8260(5035)	63-135	NA	NA	NA	
p-Bromofluorobenzene	8260(5035ext)	63-135	NA	NA	NA	
Toluene-d8	8260(5035)	64-136	NA	NA	NA	
Toluene-d8	8260(5035ext)	64-136	NA	NA	NA	

(a) No TACO value available; therefore, USEPA Region 9 Preliminary Remediation Goals were used. October 2002.

(b) Tiered Approach to Corrective Action Objectives (TACO) Program, Appendix B Table B, Lowest of the Ingestion/Inhalation Scenario. IEPA 2002.

(c) Due to structural similarities the value for 4-Methyl-2-pentanone was used.

TABLE 2B
LABORATORY CONTROL LIMITS AND DETECTION LIMITS



STL Savannah

8270 Table - Soil

Parameter	Method	Accuracy	Precision	MDL (ug/kg)	PQL (ug/kg)	DQL (ug/kg)
1,2,4-Trichlorobenzene (MS)	8270(3550)	10-112	≤22	17	330	920,000 (b)
1,2-Dichlorobenzene	8270(3550)	25-115	≤24	18	330	310,000 (b)
1,3-Dichlorobenzene	8270(3550)	26-108	≤28	17	330	310,000 (b,c)
1,4-Dichlorobenzene (MS)	8270(3550)	10-105	≤31	17	330	340,000 (b)
2,4,5-Trichlorophenol	8270(3550)	25-130	≤36	23	330	200,000X10 ³ (b)
2,4,6-Trichlorophenol	8270(3550)	41-130	≤30	20	330	390,000 (b)
2,4-Dichlorophenol	8270(3550)	32-130	≤60	22	330	610,000 (b)
2,4-Dimethylphenol	8270(3550)	33-84	≤54	22	330	41,000X10 ³ (b)
2,4-Dinitrophenol	8270(3550)	10-125	≤84	160	1700	410,000 (b)
2,4-Dinitrotoluene (MS)	8270(3550)	11-120	≤37	18	330	8,400 (b)
2,6-Dinitrotoluene	8270(3550)	10-112	≤45	40	330	8,400 (b)
2-Chloronaphthalene	8270(3550)	39-107	≤47	22	330	23,000X10 ³ (a)
2-Chlorophenol (MS)	8270(3550)	15-111	≤38	21	330	10,000,000 (b)
2-Methyl phenol (o-Cresol)	8270(3550)	33-108	≤53	25	330	100,000,000 (b)
2-Methylnaphthalene	8270(3550)	30-133	≤63	20	330	1,800 (d)
2-Nitroaniline	8270(3550)	17-130	≤48	20	1700	18,000 (a)
2-Nitrophenol	8270(3550)	30-130	≤50	32	330	7,000,000 (e)
3- and 4-Methyl phenol	8270(3550)	24-114	≤42	41	330	100,000,000 (b,f)
3,3'-Dichlorobenzidine	8270(3550)	10-115	≤39	36	660	13,000 (b)
3-Nitroaniline	8270(3550)	14-130	≤28	30	1700	18,000 (a,g)
4,6-Dinitro-2-methylphenol	8270(3550)	10-117	≤57	150	1700	na
4-Bromophenyl phenyl ether	8270(3550)	31-157	≤19	43	330	na
4-Chloro-3-methylphenol (MS)	8270(3550)	24-114	≤32	30	330	na
4-Chloroaniline	8270(3550)	10-130	≤85	24	660	820,000 (b)
4-Chlorophenylphenyl ether	8270(3550)	36-149	≤62	17	330	na
4-Nitroaniline	8270(3550)	10-130	≤55	140	1700	18,000 (a,g)
4-Nitrophenol(MS)	8270(3550)	15-118	≤57	150	1700	7,000,000 (h)
Acenaphthene (MS)	8270(3550)	18-123	≤49	17	330	120,000,000 (b)
Acenaphthylene	8270(3550)	42-119	≤48	36	330	120,000,000 (b,i)
Anthracene	8270(3550)	40-148	≤27	42	330	610,000,000 (b)
Benzo(a)anthracene	8270(3550)	54-137	≤43	17	330	8,000 (b)
Benzo(a)pyrene	8270(3550)	41-142	≤55	18	330	800 (b)
Benzo(b)fluoranthene	8270(3550)	43-134	≤51	22	330	8,000 (b)
Benzo(g,h,i)perylene	8270(3550)	10-148	≤50	17	330	61,000,000 (b,j)
Benzo(k)fluoranthene	8270(3550)	25-182	≤48	20	330	78,000 (b)
Bis(2-chloroethoxy) methane	8270(3550)	34-108	≤52	19	330	na
Bis(2-chloroethyl) ether	8270(3550)	18-122	≤50	25	330	470 (b)
Bis(2-chloroisopropyl) ether	8270(3550)	10-135	≤28	25	330	7,400 (a)
Bis(2-ethylhexyl) phthalate	8270(3550)	47-143	≤22	19	330	410,000 (b)
Butyl benzyl phthalate	8270(3550)	58-122	≤27	18	330	930,000 (b)
Carbazole	8270(3550)	10-158	≤50	36	330	290,000 (b)
Chrysene	8270(3550)	56-133	≤41	17	330	780,000 (b)
Dibenz(a,h)anthracene	8270(3550)	31-129	≤24	41	330	800 (b)
Dibenzofuran	8270(3550)	36-132	≤42	17	330	3,100,000 (a)
Diethylphthalate	8270(3550)	31-130	≤40	22	330	2,000,000 (b)

TABLE 2B
LABORATORY CONTROL LIMITS AND DETECTION LIMITS



STL Savannah

8270 Table - Soil

Parameter	Method	Accuracy	Precision	MDL (ug/kg)	PQL (ug/kg)	DQL (ug/kg)
Dimethylphthalate	8270(3550)	49-130	<=45	17	330	1X10 ⁸ (a)
Di-n-butylphthalate	8270(3550)	42-161	<=59	28	330	2,300,000 (b)
Di-n-octylphthalate	8270(3550)	22-181	<=43	22	330	4,100,000 (b)
Dinoseb	8270(3550)	10-150	<=100	21	330	620,000 (a)
Fluoranthene	8270(3550)	39-157	<=50	25	330	82,000,000 (b)
Fluorene	8270(3550)	27-151	<=50	24	330	82,000,000 (b)
Hexachlorobenzene	8270(3550)	19-155	<=33	21	330	1,800 (b)
Hexachlorobutadiene	8270(3550)	33-114	<=55	18	330	22,000 (a)
Hexachlorocyclopentadiene	8270(3550)	D-132	<=50	130	330	1,100 (b)
Hexachloroethane	8270(3550)	10-109	<=30	17	330	2,000,000 (b)
Indeno(1,2,3-cd)pyrene	8270(3550)	24-136	<=28	21	330	8,000 (b)
Isophorone	8270(3550)	15-115	<=50	17	330	4,600,000 (b)
Naphthalene	8270(3550)	25-131	<=34	25	330	1,800 (b)
Nitrobenzene	8270(3550)	19-120	<=30	17	330	9,400 (b)
N-Nitrosodiphenylamine	8270(3550)	51-132	<=44	18	330	1,200,000 (b)
N-Nitroso-di-N-propylamine (MS)	8270(3550)	11-122	<=37	27	330	800 (b)
Pentachlorophenol (MS)	8270(3550)	10-140	<=55	150	1700	24,000 (b)
Phenanthrene	8270(3550)	39-152	<=30	17	330	610,000,000 (b,k)
Phenol (MS)	8270(3550)	13-115	<=39	22	330	120,000,000 (b)
Pyrene (MS)	8270(3550)	10-133	<=42	31	330	61,000,000 (b)
Surrogates						
Phenol-d5	8270(3550)	19-114	NA	NA	NA	
p-Terphenyl-d14	8270(3550)	30-131	NA	NA	NA	
Nitrobenzene-d5	8270(3550)	20-120	NA	NA	NA	
2-Fluorobiphenyl	8270(3550)	30-120	NA	NA	NA	
2-Fluorophenol	8270(3550)	16-113	NA	NA	NA	
2,4,6- Tribromophenol	8270(3550)	23-129	NA	NA	NA	

- (a) No TACO value available; therefore, USEPA Region 9 Preliminary Remediation Goals were used. October 2002.
- (b) Tiered Approach to Corrective Action Objectives (TACO) Program, Appendix B Table B, Lowest of the Ingestion/Inhalation Scenario. IEPA 2002.
- (c) Due to structural similarities the value for 1,2-dichlorobenzene was used.
- (d) Due to structural similarities the value for naphthalene was used.
- (e) Due to structural similarities the value for 4-nitrophenol from USEPA Region 9 Preliminary Remediation Goals, 1999 was used.
- (f) Due to structural similarities the value for 2-methylphenol was used.
- (g) Due to structural similarities the value for 2-nitroaniline was used.
- (h) No TACO value available; therefore, USEPA PRGs, 1999, were used.
- (i) No TACO value available; therefore, the value for acenaphthene was used.
- (j) No TACO value available; therefore, the value for pyrene was used.
- (k) Due to structural similarities the value for anthracene was used.

TABLE 2C
LABORATORY CONTROL LIMITS AND DETECTION LIMITS



8081 Table - Soil

Parameter	Method	Accuracy	Precision	MDL (ug/kg)	PQL (ug/kg)	DQL (ug/kg)
Aldrin (MS)	8081	10-144	<=38	0.29	1.7	300 (b)
alpha-BHC	8081	22-101	<=40	0.12	1.7	900 (b)
beta-BHC	8081	12-120	<=40	0.12	1.7	4,000 (b,c)
Gamma-BHC (Lindane) (MS)	8081	12-138	<=37	0.11	1.7	4,000 (b)
delta-BHC	8081	10-142	<=47	0.25	1.7	4,000 (b,c)
alpha Chlordane	8081	45-140	<=40	0.097	1.7	1,600 (b,d)
Gamma Chlordane	8081	11-141	<=40	0.1	1.7	1,600 (b,d)
4,4'-DDD	8081	28-134	<=50	0.34	3.3	24,000 (b)
4,4'-DDE	8081	34-121	<=25	0.3	3.3	17,000 (b)
4,4'-DDT (MS)	8081	29-134	<=26	0.54	3.3	17,000 (b)
Dieldrin (MS)	8081	28-137	<=30	0.26	3.3	400 (b)
Endosulfan I	8081	10-141	<=40	0.12	1.7	1,200,000 (b,e)
Endosulfan II	8081	10-159	<=65	0.39	3.3	1,200,000 (b,e)
Endosulfan sulfate	8081	26-144	<=50	0.34	3.3	1,200,000 (b,e)
Endrin (MS)	8081	33-149	<=32	0.38	3.3	61,000 (b,f)
Endrin aldehyde	8081	10-130	<=86	0.38	3.3	61,000 (b,f)
Endrin ketone	8081	29-112	<=31	0.3	3.3	61,000 (b,f)
Heptachlor (MS)	8081	17-138	<=38	0.19	1.7	1,000 (b)
Heptachlor epoxide	8081	15-142	<=40	0.13	1.7	600 (b)
Methoxychlor	8081	24-152	<=40	0.28	17	1,000,000 (b)
Toxaphene	8081	41-126	<=50	11	170	5,200 (b)
Surrogates						
Tetrachloro-m-xylene (TCMX)	8081	30-150	NA	NA	NA	
Decachlorobiphenyl (DCB)	8081	30-150	NA	NA	NA	
680 Table - Soil						
Monochlorobiphenyls	680	30-130	<=50	0.62	3.3	1000 (b)
Dichlorobiphenyls	680	30-130	<=50	0.70	3.3	1000 (b)
Trichlorobiphenyls	680	30-130	<=50	0.69	3.3	1000 (b)
Tetrachlorobiphenyls	680	40-140	<=50	1.3	6.7	1000 (b)
Pentachlorobiphenyls	680	40-140	<=50	0.88	6.7	1000 (b)
Hexachlorobiphenyls	680	40-140	<=50	0.95	6.7	1000 (b)
Heptachlorobiphenyls	680	40-140	<=50	1.4	10	1000 (b)
Octachlorobiphenyls	680	40-140	<=50	1.3	10	1000 (b)
Nonachlorobiphenyls	680	30-130	<=50	2.6	17	1000 (b)
Decachlorobiphenyl	680	30-130	<=50	2.6	17	1000 (b)
Surrogate						
Decachlorobiphenyl-13C12	680	30-130	NA	NA	NA	

TABLE 2C
LABORATORY CONTROL LIMITS AND DETECTION LIMITS

8151 Table - Soil

Parameter	Method	Accuracy	Precision	MDL (ug/kg)	PQL (ug/kg)	DQL (ug/kg)
2,4-D (MS)	8151	19-153	<=47	2.4	8.3	2,000,000 (b)
Dalapon	8151	10-170	<=40	2	2000	6,100,000 (b)
2,4-DB	8151	20-160	<=40	1.1	8.3	4,900,000 (a)
Dicamba	8151	20-160	<=40	1.7	20	18,000,000 (a)
Dichlorprop	8151	30-170	<=40	0.8	100	na
MCPA	8151	10-130	<=50	74	2000	310,000 (a)
MCPP	8151	10-130	<=50	120	2000	620,000 (a)
Pentachlorophenol	8151	10-150	<=40	0.72	17	24,000 (b)
2,4,5-T (MS)	8151	14-143	<=59	0.87	8.3	6,200,000 (a)
2,4,5-TP (Silvex) (MS)	8151	27-120	<=51	1.5	8.3	1,600,000 (b)
Surrogates						
2,4-Dichlorophenyl acetic acid (DCAA)	8151	30-189	NA	NA	NA	

(a) No TACO value available; therefore, USEPA Region 9 Preliminary Remediation Goals were used. October 2002.

(b) Tiered Approach to Corrective Action Objectives (TACO) Program, Appendix B Table B, Lowest of the Ingestion/ Inhalation Scenario. IEPA 2002.

(c) Due to structural similarities the value for gamma-BHC was used.

(d) Due to structural similarities the value for chlordane was used.

(e) Due to structural similarities the value for endosulfan was used.

(f) Due to structural similarities the value for endrin was used.

TABLE 2D
LABORATORY CONTROL LIMITS AND DETECTION LIMITS

8280A Table - Soil						
Parameter	Method	Accuracy	Precision	MDL (ug/kg)	PQL (ug/kg)	DQL (ug/kg)
2,3,7,8-TCDD	8280	66-139	<=50	NA	1	1 (a)
1,2,3,7,8-PeCDD	8280	55-145	<=50	NA	2.5	1 (a)
1,2,3,4,7,8-HxCDD*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,6,7,8-HxCDD	8280	63-135	<=50	NA	2.5	1 (a)
1,2,3,7,8,9-HxCDD*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,4,6,7,8-HpCDD	8280	55-138	<=50	NA	2.5	1 (a)
OCDD	8280	52-139	<=50	NA	5	1 (a)
2,3,7,8-TCDF	8280	70-128	<=50	NA	1	1 (a)
1,2,3,7,8-PeCDF	8280	59-137	<=50	NA	2.5	1 (a)
2,3,4,7,8-PeCDF*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,4,7,8-HxCDF*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,6,7,8-HxCDF	8280	64-136	<=50	NA	2.5	1 (a)
2,3,4,6,7,8-HxCDF*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,7,8,9-HxCDF*	8280	50-150	<=50	NA	2.5	1 (a)
1,2,3,4,6,7,8-HpCDF	8280	73-130	<=50	NA	2.5	1 (a)
1,2,3,4,7,8,9-HpCDF*	8280	50-150	<=50	NA	2.5	1 (a)
OCDF	8280	60-136	<=50	NA	5	1 (a)
Internal Standards						
13C-2,3,7,8-TCDF	8280	25-150	NA	NA		
13C-2,3,7,8-TCDD	8280	25-150	NA	NA		
13C-1,2,3,6,7,8-HxCDD	8280	25-150	NA	NA		
13C-1,2,3,4,6,7,8-HpCDF	8280	25-150	NA	NA		
13C-OCDD	8280	25-150	NA	NA		
Surrogate						
37Cl-2,3,7,8-TCDD	8280	25-150	NA	NA		

Notes:

NA = Not Applicable

(*) = Compound is not a method specified control analyte. All limits are advisory.

Source: STL Sacramento

(a) USEPA 1998, Approach for Addressing Dioxins in Soil at CERCLA and RCRA sites. Value for Dioxins.

TABLE 2E
LABORATORY CONTROL LIMITS AND DETECTION LIMITS



STL Savannah



Parameter	Method	Accuracy	Precision	MDL (mg/kg)	PQL (mg/kg)	DQL (mg/kg)
Aluminum (ICP)	6010	75-125	<=20	1	20	100,000 (a)
Antimony (ICP)	6010	75-125	<=20	0.45	2	82 (b)
Arsenic (ICP)	6010	75-125	<=20	0.34	1	61 (b)
Barium (ICP)	6010	75-125	<=20	0.04	1	14,000 (b)
Beryllium (ICP)	6010	75-125	<=20	0.015	0.4	410 (b)
Cadmium (ICP)	6010	75-125	<=20	0.037	0.5	200 (b)
Calcium (ICP)	6010	75-125	<=20	1.8	50	NA
Chromium (ICP)	6010	75-125	<=20	0.077	1	420 (b)
Cobalt (ICP)	6010	75-125	<=20	0.055	1	12,000 (b)
Copper (ICP)	6010	75-125	<=20	0.15	2	8200 (b)
Iron (ICP)	6010	75-125	<=20	2.5	5	100,000 (a)
Lead (ICP)	6010	75-125	<=20	0.21	0.5	400 (b)
Magnesium (ICP)	6010	75-125	<=20	0.68	50	NA
Manganese (ICP)	6010	75-125	<=20	0.11	1	8,700 (b)
Nickel (ICP)	6010	75-125	<=20	0.18	4	4,100 (b)
Potassium (ICP)	6010	75-125	<=20	1.3	100	NA
Selenium (ICP)	6010	75-125	<=20	0.53	1	1,000 (b)
Silver (ICP)	6010	75-125	<=20	0.091	1	1,000 (b)
Sodium (ICP)	6010	75-125	<=20	16	50	NA
Thallium (ICP)	6010	75-125	<=20	0.52	1	160 (b)
Vanadium (ICP)	6010	75-125	<=20	0.096	1	1,400 (b)
Zinc (ICP)	6010	75-125	<=20	1.4	2	61,000 (b)
Cyanide (ICP)	9010	75-125	<=30	0.5	1	4,100 (b)
Mercury (ICP)	7471	80-120	<=20	0.0043	0.02	61 (b)

Notes:

NA = Not Applicable

(a) No TACO value available; therefore, USEPA Region 9 Preliminary Remediation Goals were used. October 2002.

(b) Tiered Approach to Corrective Action Objectives (TACO) Program, Appendix B Table B, Lowest of the Ingestion/ Inhalation Scenario. IEPA 2002.

TABLE 3
Field Sampling Summary for Chemical Analyses

Parameter (Critical Method)	Matrix	Sample Containers And Volumes	Preservation	Holding Times	Number Of Samples	Field Duplicate	QC Sample Frequency		
							Trip Blank	MS/MSD /Spike Duplicate*	Equip. Blank**
VOCs (EPA Method 8260B) ¹	soil	3- Encore sampler™ (or in accordance with USEPA Method 5035)	4°C	Transferred to soil container or analyzed 48 hours from collection	61 surface 60 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (12)	1 ea. per cooler with VOC samples	One per 20 samples or one per matrix (for less than 20 samples) (6)	One per 10 samples as required (12)
SVOCs (EPA Method 8270C) ¹	soil	250 milliliter wide mouth glass container with Teflon® lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis	61 surface 60 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (12)	NA	One per 20 samples or one per matrix (for less than 20 samples) (6)	One per 10 samples as required (12)
Pesticides, Herbicides (EPA Methods 8081A, 8151) ¹	soil	250 milliliter wide mouth glass container with Teflon® lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis	31 surface 30 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (6)	NA	One per 20 samples or one per matrix (for less than 20 samples) (4)	One per 10 samples as required (6)
PCBs (EPA Method 680) ²	soil	500 milliliter wide mouth glass container with Teflon® lined lid	4°C	14 days from collection to extraction; 40 days from extraction to analysis	47 surface 46 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (10)	NA	One per 20 samples or one per matrix (for less than 20 samples) (5)	One per 10 samples as required (10)
***Dioxin, Dibenzofuran (EPA Method 8280A) ¹	soil	100 grams in 4 oz. amber glass jar with Teflon® lined lid	4°C	30 days from collection to extraction; 45 days from extraction to analysis	47 surface 46 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (10)	NA	One per 20 samples or one per matrix (for less than 20 samples) (5)	One per 10 samples as required (10)
Metals (EPA Method 6010B) ¹	soil	4 ounce wide mouth polyethylene or fluorocarbon (TFE or PFA) container	4°C	180 days from collection generation, 180 days from extraction to analysis	47 surface 46 subsurface	One per 10 samples or one per matrix (for less than 10 samples) (10)	NA	One per 20 samples or one per matrix (for less than 20 samples) (10)	One per 10 samples as required (5)

Notes:

- * MS/MSD indicates matrix spike/matrix spike duplicate sample for organic analyses. Spike duplicate is performed for inorganic analyses.
- ** Field/equipment blank is required at a frequency of one per 10 samples or one per matrix if less than ten samples are collected. Equipment blank is not required if disposable equipment is used.
- *** For dioxin and dibenzofuran sample collection, QC samples, including MS/MSD and field duplicates must be clearly noted on the chain-of-custody.

Equip. indicates equipment.

VOCs indicate volatile organic compounds.

SVOCs indicate semivolatile organic compounds.

PCBs indicate polychlorinated biphenyls.

NA indicates not applicable.

1 USEPA. 1996a. *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods, SW-846*, 3rd Edition. Washington D.C.

2 Phone conversation with Steve White from Savannah Laboratory on February 6, 2001.

TABLE 4A
VOLATILE ORGANIC COMPOUNDS USING USEPA METHOD 8260B
QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS

Audit	Frequency	Control Limits	Corrective Action
Holding times	Samples must be extracted and analyzed within holding time.	VOCs: Analyze within 14 days from collection.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify QAO* immediately since re-sampling may be required. Document corrective action in the case narrative.
MS Tuning	Once every 12 hours prior to initial calibration and calibration verifications.	<ol style="list-style-type: none"> 1. BFB key ions and abundance criteria listed in the method must be met for all 9 ions and analyses must be performed within 12 hours of injection of the BFB. 2. Part of the BFB peak will not be background subtracted to meet tune criteria. 3. Documentation of all BFB analyses and evaluation must be included in the data packages. 	<ol style="list-style-type: none"> 1. Tune the mass spectrometer. 2. Document corrective action in the case narrative – samples cannot be analyzed until control limit criteria have been met.
Initial Calibration	Prior to sample analysis and when calibration verifications criteria are not met. Initial calibration will contain all target analytes in each standard.	<ol style="list-style-type: none"> 1. Five concentrations bracketing expected concentration range for all compounds of interest; one std must be near the PQL. 2. CCC compounds <30% RSD, remaining compounds ≤50% RSD. 3. SPCC RF as listed in method, non-SPCC $RF \geq 0.050$ except for ketones and 2-chloroethyl vinyl ether with $RF \geq 0.010$. 4. For compound with %RSD >15, quantitation must be performed using a separate calibration curve and the COD must be > 0.99. 	<ol style="list-style-type: none"> 1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document corrective action in the case narrative – samples cannot be analyzed until calibration control limit criteria are met. <p>Contact QAO* to discuss problem target analytes such as 2-chloroethyl vinyl ether before proceeding with analysis.</p>
Internal Standards	All samples and blanks (including MS/MSD)	<ol style="list-style-type: none"> 1. Response –50% - +100% of internal standards from continuing calibration of the day. 2. RT must be ± 30 sec. From associated calibration verification standard of that sequence. 	<ol style="list-style-type: none"> 1. Reanalyze. 2. If still outside of the limits, report both analyses, and contact the QAO*. 3. Document corrective action in the case narrative. <p>Special Circumstances: If matrix interferences is present (as demonstrated by the lab and documented in the case narrative):</p> <ol style="list-style-type: none"> 1. Reanalyze (may be at a higher dilution) 2. If internal standard is >10%, report both runs. 3. If internal standard is <10%, report both runs and contact QAO*.

TABLE 4A
VOLATILE ORGANIC COMPOUNDS USING USEPA METHOD 8260B
QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS

Audit	Frequency	Control Limits	Corrective Action
Surrogate Spike	All samples and blanks (including MS/MSD)	Recovery within laboratory control limits.	<ol style="list-style-type: none"> 1. Reanalyze any environmental or QC sample with surrogates that exceed control limits. 2. If still outside of the limits, report both analyses and contact the QAO*. 4. Document corrective action in the case narrative. <p>Special Circumstances: If matrix interferences is present (as demonstrated by the lab and documented in the case narrative):</p> <ol style="list-style-type: none"> 1. Reanalyze (may be at a higher dilution) 2. If surrogate standard is >10%, report both runs. 3. In surrogate standard is <10%, report both runs and contact QAO*.
Matrix Spike/Matrix Spike Dup. (MS/MSD) Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	Recovery and RPD within laboratory control limits. Spike must contain target analysis.	<ol style="list-style-type: none"> 1. Reanalyze if <10%. 2. If reanalysis is still <10%, report both analyses and document in the case narrative. 3. If >10% and LCS criteria are met, document in case narrative; no additional corrective action required. 4. If LCS criteria are exceeded also, examine other QC data for source of problem; i.e., surrogate recoveries for extraction efficiency and calibration data for instrument performance issues, and contact QAO*. Re-extract or reanalyze samples and associated MS/MSD and LCSs as required.
Field Dup. Analysis	Collected 1 per matrix; every 10 samples of similar matrix	50% RPD for waters and 100% RPD for soil	If these criteria are not met, sample results will be evaluated on a case by case basis.
Percent solids	For soil samples, the percent solids will be determined and sample results will be corrective for percent solids.	Not applicable	Not applicable
Continuing Calibration	Every 12 hours. Calibration verification will contain target analytes at a concentration that is representative of the midpoint of the initial calibration.	<ol style="list-style-type: none"> 1. Within method specified criteria, percent drift or percent difference (%D) ≤ 20 for CCC and ≤ 50 for remaining compounds. SPCC RF as listed in method; non SPCC RF ≥ 0.050 except for Ketones and 2-CEVE with RF of ≥ 0.010. 2. The internal standards areas and retention times must meet the method criteria. 	<ol style="list-style-type: none"> 1. Re-analyze 2. If criteria are still not met, identify and correct problems, recalibrate and notify QAO. 3. Document corrective action in the case narrative- samples cannot be analyzed until calibration control limit criteria are met. If the laboratory chooses to apply the grand mean exception (average % drift or % difference is less than 15 %) the QAO will be contacted prior to proceeding with analysis.

Notes:

* Indicates that data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in Section 9.2.2 of this QAPP.

QAO* indicates that communications with the QAO will be documented and included in the data packages.

TABLE 4B
SEMIVOLATILE ORGANIC COMPOUNDS USING USEPA METHOD 8270C
QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS*

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be extracted and analyzed within holding time.	SVOCs: Extract within 7 days for aqueous and 14 days for soil samples from collection. Analyze extracts within 40 days of extraction.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the QAO* immediately since re-sampling may be required
MS Tuning	Once every 12 hours prior to initial calibration and calibration verification.	<ol style="list-style-type: none"> 1. DFTPP key ions and abundance criteria listed in the method must be met for all 13 ions and analyses must be performed within 12 hours of injection of the DFTPP. 2. Part of the DFTPP peak will not be background subtracted to meet tune criteria. 3. Documentation of all DFTPP analyses and evaluations must be included in the data packages. 	<ol style="list-style-type: none"> 1. Tune the mass spectrometer. 2. Document corrective action in the case narrative – samples cannot be analyzed until control limit criteria have been met.
Initial Calibration	Prior to sample analysis and when calibration verification criteria are not met. Initial calibration will contain all target analytes in each standard.	<ol style="list-style-type: none"> 6. Five concentrations bracketing expected concentration range for all compounds of interest; one standard must be near the PQL. 7. CCC compounds meet method RSD, remaining compounds $\leq 50\%$ RSD. 8. SPCC RF as listed in method, non-SPCC ≥ 0.050 RF. 9. For compounds with $\%RSD > 15$, quantification must be performed using a separate calibration curve and the COD must be ≥ 0.99. 	<ol style="list-style-type: none"> 1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document corrective action in the case narrative – samples cannot be analyzed until calibration control limit criteria are met. <p>Contact QAO* to discuss problem target analytes such as 2-chloroethyl vinyl ether before proceeding with analysis.</p>
Calibration Verification	Every 12 hours, following DFTPP. Calibration verification will contain all target analytes in each standard at a concentration that is representative of the midpoint of the initial calibration.	<ol style="list-style-type: none"> 1. Within method specified criteria, percent drift or percent difference ($\%D$) ≤ 20 for CCC compounds and $\leq 50\%D$ for remaining compounds, SPCC RF as listed in method, non-SPCC ≥ 0.050. 2. The internal standards areas and retention times must meet the method criteria. 	<ol style="list-style-type: none"> 1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate and notify QAO*. 3. Document corrective action in the case narrative – samples cannot be analyzed until calibration control limit criteria are met. <p>If the laboratory chooses to apply the grand mean exception (average $\%$ drift or $\%$ difference is less than 15%), the QAO* will be contacted prior to proceeding with analysis.</p>
Surrogate Spike	All samples and blanks (including MS/MDS)	Recovery within laboratory control limits.	<ol style="list-style-type: none"> 1. Reanalyze if more than 1 AE or 1 BS fails, or if any one surrogate $\%R$ is $< 10\%$. 2. If recovery is still outside control limits and if the recovery is $< 10\%$, re-extract if still in holding time. 3. If recovery is still outside control limits, and if recovery is $> 10\%$, report both analyses. 4. Document corrective action in the case narrative. <p>Special Circumstances: If matrix interference is present (as demonstrated by the lab and documented in the case narrative):</p> <ol style="list-style-type: none"> 1. Reanalyze (may be at a higher dilution). 2. If surrogate recovery is $> 10\%$, report both runs.

TABLE 4B
SEMIVOLATILE ORGANIC COMPOUNDS USING USEPA METHOD 8270C
QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS*

Audit	Frequency	Control Limits	Corrective Action
			3. If surrogate recovery is <10%, report both runs and contact QAO*.
Matrix Spike/Matrix Spike Dup. (MS/MSD) Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater.	Recovery and RPD within laboratory control limits. Spike must contain target analysis.	1. Reanalyze if <10%. 2. If reanalysis is still <10%, report both analyses and document in the case narrative. 3. If >10% and LCS criteria are met, document in case narrative. 4. If LCS criteria are exceeded also, examine other QC data for source of problem; i.e., surrogate recoveries for extraction efficiency and calibration data for instrument performance issues, and contact QAO* and re-extract or reanalyze samples and associated MS/MSD and LCSs as required.
Field Dup. Analysis	Collected 1 per matrix; every 10 samples of similar matrix	50% RPD for waters and 100% RPD for soil	If these criteria are not met, sample results will be evaluated on a case by case basis.
Internal Standard	All samples and blanks (including MS/MSD).	1. Response -50% to + 100% of internal standards from continuing calibration of the day. 2. RT must be ± 30 sec. From associated calibration verification standard of that sequence.	1. Re-analyze 2. If still outside of the limits, report both analyses and contact the QAO. 3. Document corrective action in the case narrative. Special Circumstances: If matrix interferences are present (as demonstrated by the lab and documented in the case narrative): Re-analyze (may be at a higher dilution) If internal standard in >10%, report both runs. If internal standard is <10%, report both runs and contact QAO.

Notes:

* Indicates that data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in Section 9.2.2 of this QAPP.

QAO* indicates that communications with the QAO will be documented and included in the data packages.

TABLE 4C
PESTICIDES SW-846 METHOD 8081A AND HERBICIDES SW-846 METHOD 8151A
QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS

Audit	Frequency	Control Limits	Corrective Action
Holding times	Samples must be extracted and analyzed within holding time.	Extract within 7 days for aqueous and 14 days for soil samples from collection. Analyze extracts within 40 days.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify QAO immediately since re-sampling may be required.
Initial Calibration	Prior to start up and when criteria are exceeded for continuing calibration.	<ol style="list-style-type: none"> 1. Minimally five concentrations, one calibration standard must be at concentration less than or equal to the PQL. 2. Toxaphene, technical chlordane require a single point calibration. If detected in samples, the samples are re-analyzed behind a five point calibration for each detected analyte. 3. If RSD <20% the average RRF may be used for quantitation. If RSD >20% a first or second order calibration curve with a correlation coefficient >0.99 must be used for quantitation. 	<ol style="list-style-type: none"> 1. Identify and correct problem. 2. Recalibration instrument; samples must not be analyzed until initial calibration criteria are met.
Calibration Verification	<p>Calibration standards must contain target compounds at mid-range concentration.</p> <p>Minimally, analyze calibration standards daily and every 12 hours. Calibration verification standards should be analyzed every 20 samples.</p>	%D <15%	<ol style="list-style-type: none"> 1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard. Samples must be bracketed by compliant calibration standards. <p>If the laboratory chooses to apply the grand mean exception (average % drift or % difference is less than 15%), the QAO* will be contacted prior to proceeding with analysis.</p>
Retention Time Windows	Retention time windows must be established in accordance with USEPA method 8000 or relative retention times must be used if internal standards are employed.	Compounds must be within established retention time windows or within laboratory established relative retention time criteria for the succeeding calibration standards.	<ol style="list-style-type: none"> 1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; reanalyze samples back to last compliant calibration standard.

TABLE 4C
PESTICIDES SW-846 METHOD 8081A AND HERBICIDES SW-846 METHOD 8151A
QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS

Audit	Frequency	Control Limits	Corrective Action
Surrogate Spike	Samples, blanks, MS/MSDs, and LCSs must be spiked with method specific surrogate compounds.	<ol style="list-style-type: none"> 1. Recovery within laboratory control limits. 2. Corrective action is not required if one of the two required surrogates has recovery outside of control limits if the recovery is >10%. 	<ol style="list-style-type: none"> 1. Reanalyze 2. If recovery is still outside control limits but >10%, document in case narrative report. 3. If recovery is <10% with re-analysis, re-extract and re-analyze the sample if the holding time has not elapsed. If holding time has elapsed, notify the QAO immediately prior to proceeding since resampling may be required. <p>Special Circumstances: If matrix interferences is present (as demonstrated by the lab and documented in the case narrative):</p> <ol style="list-style-type: none"> 1. Reanalyze (may be at a higher dilution) 2. If surrogate standard is >10%, report runs. 3. In surrogate standard is <10%, contact QAO*.
Identification	Samples, blanks, and QC data.	<ol style="list-style-type: none"> 1. Retention times must be within established retention time windows or must meet relative retention time criteria. 2. Confirmation analysis is required. 	<ol style="list-style-type: none"> 1. Investigate problem; re-analyze calibration standards to check for retention time shift.
Quantitation	Samples, blanks, and QC data.	<ol style="list-style-type: none"> 1. Internal and external standard method. Verify concentration is within linear calibration range. 2. For DROs, use the sum of the areas of peaks eluting between C10 and C28. 3. Every effort must be made to meet specified PQL requirements. Soil samples concentrations must be corrected to dry weight. 	<ol style="list-style-type: none"> 1. If concentration is above linear calibration range, dilute sample and re-analyze. Dilution should result in concentration in the upper calibration range of the instrument.
Field/ Equipment Blank Analysis	Collected one per sampling equipment and after every 10 samples.	Compounds concentrations must be <PQL.	<ol style="list-style-type: none"> 1. Investigate problem; re-analyze to verify laboratory cross contamination is not a factor. 2. Notify the QAO immediately since resampling may be necessary.

TABLE 4D
PCBs METHOD 680 BY SELECTED ION MONITORING (SIM) MODE
QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be extracted and analyzed within holding time.	Extract within 7 days for aqueous and 14 days for soil samples from collection. Analyze extracts within 40 days of extraction.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the QAO* immediately since re-sampling may be required.
MS Tuning	At the beginning of the 12 hour sequence. Prior to calibration, blank, sample and QC sample analysis.	<ol style="list-style-type: none"> 1. Tune instrument in accordance with Method 680. 2. Size of DFTPP peak should be within instrument specific established area window. 	<ol style="list-style-type: none"> 1. Identify and correct problem. 2. Re-tune the mass spectrometer; samples must not be analyzed until tuning criteria are met.
Initial Calibration	Prior to start up after tuning and when criteria are exceeded for continuing calibration.	<ol style="list-style-type: none"> 1. Minimally five concentrations, one calibration standard must be at concentration less than or equal to the PQL. 2. Toxaphene, technical chlordane require a single point calibration. If detected in samples, the samples are re-analyzed behind a five point calibration for each detected analyte. 3. If RSD <20% the average RRF may be used for quantitation. If RSD >20% a first or second order calibration curve with a correlation coefficient >0.99 must be used for quantitation. 	<ol style="list-style-type: none"> 1. Identify and correct problem. 2. Recalibrate instrument; samples must not be analyzed until initial calibration criteria are met.
Calibration Verification	Calibration standards must contain target compounds at mid-range concentration. Minimally, analyze calibration standards prior to sample analysis and at the end of the sample sequence, and every 12 hours.	<ol style="list-style-type: none"> 1. %D <20% for water, 30% for soil. 2. Mass abundance ratio of all calibration congeners within acceptable range. 3. Baseline separators of PCB congener #87 from #154 and #77. 4. Signal to noise ratio of ≥ 5 for decachlorobiphenyl ion #499 and chrysene-d12 ion #241. 5. Decachlorobiphenyl mass abundances for mass 500 $\geq 70\%$ and $\leq 95\%$ for mass 498. 	<ol style="list-style-type: none"> 1. Reanalyze. 2. If criteria are still not met, identify and correct problem, recalibrate; re-analyze samples back to last compliant calibration standard. Samples must be bracketed by compliant calibration standards.

TABLE 4D
PCBs METHOD 680 BY SELECTED ION MONITORING (SIM) MODE
QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS

Audit	Frequency	Control Limits	Corrective Action
Identification	Samples, blanks, and QC data.	<ol style="list-style-type: none"> 1. The retention time must be within the corresponding retention time established by the window defining mixture for each chlorination level. 2. The ion current response for both ions must reach a maximum with ± 1 scan. 3. Ion abundance ratios specified in SOP must be met. 4. The area of the ions must be >3 times the background noise. 5. At least one ion in the M-70 cluster must be present. 6. Evaluate PCBs in the CI-3 to CI-7 range for coeluting PCBs. See SOP Section 11.1.3. 7. Examine data for presence of PCB of higher chlorination level if both ions and M-70 ions are present and the ratio does not fall within acceptable limits. 	<ol style="list-style-type: none"> 1. If identification criteria are not all met, but in the judgment of the operator the target compound is present, proceed with quantitation and document reasoning in the data package.
Equipment Blank Analysis	1 per sampling equipment and after collection of 10 samples.	Compounds concentration must be $<$ reporting limit.	<ol style="list-style-type: none"> 1. Investigate problem; re-analyze to verify laboratory cross contamination is not a factor. 2. Notify QAO Officer since resampling may be necessary.
Field Duplicate Analysis	Collected every 10 samples	<p>Aqueous: RPD $\leq 50\%$ for results $>5 \times \text{CRQL}$.</p> <p>Soils: RPD $\leq 100\%$ for results $>5 \times \text{CRQL}$.</p> <p>For Results $<5 \times \text{CRQL}$ must agree with $\pm 2 \times \text{CRQL}$ for aqueous and soils.</p>	No corrective action required of the laboratory since the laboratory will not know the identity of the field duplicate samples. If these criteria are not met, sample results will be evaluated on a case by case basis during the validation process..

TABLE 4E
PCDD/PCDF METHOD 8280A QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS

Audit	Frequency	Control Limits	Corrective Action
Holding Time	Samples must be extracted and analyzed within holding time.	Extract within 30 days of VTSR for extraction, 45 days for analysis of samples. Cleanup using alumina, silica gel and activated carbon as needed.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the QAO immediately since re-sampling may be required.
MS Tuning	At the beginning of the 12 hour sequence. Prior to calibration, blank, sample and QC sample analysis.	Tune instrument using FC43 in accordance with Method 8280A. Total cycle time must be \leq 1.0 second	1. Identify and correct problem. 2. Re-tune the mass spectrometer; samples must not be analyzed until tuning criteria are met.
GC Column Performance Check (WDM)	At the beginning of 12 hour sequence, prior to ICAL or CCAL.	Must contain the first and last for each homologous series tetra- through heptachlorinated congeners. Column resolution must be evaluated in the CCAL per Sections 7.12.1 and 7.13.3.6 of Method 8280A. Additionally, instrument sensitivity check (CC1) must be analyzed at the end of 12-hour period per Section 7.13.3.7 of Method 8280A.	1. Identify and correct problem. 2. Re-analyze; samples must not be analyzed until GC performance check criteria are established.
Selective Ion Monitoring (SIM) Descriptions	Acquire SIM data for all ions listed in the five descriptors.	The ions listed in Method 8280A, Table 7 must be monitored. The tetra and penta chlorinated dioxins and furans can be combined.	1. Identify and correct problem. 2. Document in case narrative.
Surrogate or Alternate Standards	Samples, blanks, and MS/MSDs are to be spiked with the compounds listed in Table 3 of Method 8280A.	Percent recoveries must be within 8280A criteria.	1. Re-extract and/or re-analyze. 2. If re-extraction and re-analysis does not solve problem and other QC criteria were met, submit both runs and discuss in narrative report.
Recovery Standard	Consists of 13C-1,2,3,4-TCDD and 13C-1,2,3,7,8,9-HxCDD, which are added to field samples, blanks, and QC samples prior to sample injection.	Recovery standards are used to calculate internal standard recovery. The recovery standard must elute within 10 seconds of the same standards in the continuing calibration at the start of the 12-hour analytical sequence.	1. Re-analyze. 2. If re-extraction and re-analysis does not solve problem and other QC criteria were met, submit both runs and discuss in narrative report.

TABLE 4E
PCDD/PCDF METHOD 8280A QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS

Audit	Frequency	Control Limits	Corrective Action
Method Blank Analysis	1/20 samples of similar matrix extracted at the same time, analyzed between the calibration standard and samples.	Compound concentrations must be < CRQL (PQL).	<ol style="list-style-type: none"> 1. Re-analyze 2. Assess impact on data. 3. If limits are still exceeded and impact is adverse, re-extract and re-analyze method blank and associated samples if holding times have not elapsed. 4. If holding times have elapsed, contact QAO Manager since re-sampling may be required.
MS/MSD Analysis	1/matrix type and every 20 samples of similar matrix.	Recovery and RPD within Table 6I limits.	<ol style="list-style-type: none"> 1. Re-analyze. 2. Recovery or RPD is still outside limits, document in case narrative report.
Duplicate Analysis	1/ sample batch.	RPD within 50%.	<ol style="list-style-type: none"> 1. Re-analyze. 2. RPD is still outside limits, document in case narrative report.
Quantitation	Samples, blanks, and QC data.	<p>Based upon five-point calibration curve for each homologue. (See Table 1 of Method 8280A)</p> <p>Quantitation based upon Section 7.15 of Method 8280A.</p> <p>Extract should be analyzed on DB-225 column if 2,3,7,8-TCDF is detected and the TEQ value is above the levels stated in Section 7.15.8.2.1 of Method 8280A</p>	<ol style="list-style-type: none"> 1. If peak is saturated, dilute sample and re-analyze. 2. Perform appropriate cleanup procedures as necessary to minimize sample matrix effects. 3. If PCDD/PCDF conc. is greater than the calibration limit. A dilution analysis will be performed.
Sample Specific Estimated Detection Limit (EDL)	Sample specific EDL is the concentration of an analyte required to produce a signal with a peak height of at least 2.5 times the background signal.	Calculate an EDL for each 2,3,7,8-substituted congener that is not identified.	Not Applicable.

TABLE 4E
PCDD/PCDF METHOD 8280A QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS

Audit	Frequency	Control Limits	Corrective Action
Identification	Samples, Blanks, and QC data	<p>For PCDD/PCDF congeners, which has labeled internal or recovery standard present, the retention time of sample component for the two Quantitation ions must be within -1 to +3 seconds of the labeled standard.</p> <p>For other compounds, the retention time must be within the corresponding homologous retention time established by the GC column performance check standard.</p> <p>The ion current response for both ions must reach a maximum with ± 1 scan. Ion abundance ratios specified in Method must be met.</p> <p>Signal-to-noise ratio (S/N): all ion current intensities must be 2.5 times for positive identification of a PCDD/PCDF compound or a group of coeluting isomers.</p>	<p>1. If identification criteria are not all met, but in the judgment of the operator the compound is present, proceed with Quantitation and document reasoning in the data package.</p>
Calibration	<p>Before any samples are analyzed, when criteria are exceeded for the continuing calibration verification, and if calibration, sample fortification (internal standard) or recovery standard solutions are replaced with a different lot.</p> <p>Minimally, five concentration calibration solutions are required using the specifications and calibration ranges indicated in Table 1 of Method 8280A.</p>	<p>Relative ion abundance criteria specified in Method 8280A Table 9 must be met.</p> <p>The S/N ratio for each GC signal, including the labeled internal standards, must be ≥ 10.</p> <p>The %RPD for the unlabeled analytes and labeled internal standards must be $\leq 15\%$.</p>	<p>1. Identify and correct problem.</p> <p>2. Recalibrate the instrument. Samples must not be analyzed until the initial calibration criteria are met.</p>

TABLE 4F

**METALS SW-846 METHOD 6010B, MERCURY SW-846 METHOD 7470A, 7471A, AND CYANIDE SW-846 METHOD 9010B/9012A
QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS**

Audit	Frequency	Control Limits	Corrective Action
Holding Times	Samples must be digested and analyzed within holding time.	Metals: Analyze 180 days from collection. Mercury: Analyze 28 days from collection. Cyanide: Analyze 14 days from collection.	If holding times are exceeded for initial or any re-analyses required due to QC excursions, notify the QAO immediately since re-sampling may be required.
Calibration Verification (ICV, CCV)	Two point calibration for ICP. Five point calibration for remaining methods. Calibrate according to method and each time instrument is set up; verify at more frequent of 10% or each 2 hours. Also verify at the end of each run. Analyze highest mix standard before sample analysis (ICP only). Standard at or below the PQL should be analyzed after initial calibration. Mercury standard should be less than or equal to 5 times the PQL.	90% to 110% of expected value for ICP AA, colorimeter, and spectrophotometer. 80% to 120% of expected true value for Mercury. Highest standard mix $\pm 5\%$ of true value for ICP. Correlation coefficient for first or second order curve must be ≥ 0.995 .	1. Re-analyze. 2. If criteria are still not met, identify and correct problem, recalibrate. 3. Document corrective action – samples cannot be analyzed until calibration control limit criteria have been met.
Calibration Blank	At the beginning and end of run and at a rate of 10% during run.	Less than PQL.	1. Identify and correct problem. 2. If criteria are still not met, recalibrate. 3. Document corrective action – samples cannot be analyzed until calibration control limit criteria have been met.
Preparation Blank Analysis	1 per batch of samples digested, or 1 in 20, whichever is greater.	Less than PQL.	1. Re-analyze blank. 2. If limits are still exceeded, clean instrument and recalibrate. 3. Document corrective action – samples cannot be analyzed until calibration control limit criteria have been met.
Laboratory Duplicate or Matrix Spike Duplicate Analysis	1 per group of similar concentration and matrix, 1 per case of samples, or 1 in 20, whichever is greater	RPD less than in-house limits for conc > 5X PQL. Abs. difference less than 2X PQL otherwise.	1. Investigate problem and reanalyze. 2. Document corrective action.

TABLE 4F
METALS SW-846 METHOD 6010B, MERCURY SW-846 METHOD 7470A, 7471A, AND CYANIDE SW-846 METHOD 9010B/9012A
QUALITY CONTROL REQUIREMENTS AND CORRECTIVE ACTIONS

Audit	Frequency	Control Limits	Corrective Action
Field Dup. Analysis	Collected 1 per matrix; every 10 samples of similar matrix	50% RPD for waters and 100% RPD for soil.	If these criteria are not met, sample results will be evaluated on a case by case basis.
Furnace Analysis	Two samples in each analytical batch must be injected in duplicate and spiked; method of standard additions is required when the sample absorbance or concentration is $\geq 50\%$ of the spike concentration and the % recovery is not within control limits.	% Recovery 85% to 115%, Relative Standard Deviation $<20\%$. MSA correlation coefficient > 0.995 .	1. Dilute and reanalyze if $<40\%$ recovery, reanalyze 40% - 60% recovery and no MSA. 2. If limits are still exceeded, qualify data. 3. Document corrective action.

Note

*Indicates that data validation will be performed in accordance with QA/QC criteria established in these tables and the analytical methods. Excursions from QA/QC criteria will be qualified based on guidance provided in Section 9.2.2 of this QAPP>

QAO* indicates that communications with the QAO will be documented and included in the data packages.

TABLE 5
LABORATORY STANDARD OPERATING PROCEDURES (SOPS) AND QUALITY
ASSURANCE MANUAL (AQM) FOR SEVERN TRENT LABORATORIES
(Laboratories Located At Savannah, GA and Sacramento, CA)

Laboratory SOP Site	SOP No.	SOP Date
Chlorinated Herbicides (Methods 615 and 8151A)	SG65	1/14/99
Total Cyanide and Cyanide Amenable to Chlorination by Manual Distillation	GE46-M	11/25/97
Mercury: Varian Spectra AA 20	ME26	5/1/98
Mercury Analysis: Leeman PS200	ME28	12/19/97
Mercury Preparation: Leeman AP200	ME29	1/20/98
Digestion Procedures for ICP Total Metals in Soils, Sediments, Wastes and Oils	ME51	7/6/98
Digestion Procedures for Graphite Furnace Atomic Absorption Total Metals in Soils, Sediments, Wastes and Oils	ME61	7/6/98
Elements by ICP (Methods 200.7 and 6010B)	ME70	6/19/98
Receipt Log Number Assignment and Distribution of Field Samples	CUO1	4/05/02
Internal Chain of Custody	CUO2	7/10/98
Preparation of Sampling Kits	CU15	6/24/98
Continuous Liquid-Liquid Extraction	EX30	8/27/98
Ultrasonic Extraction	EX40	2/20/98
Extraction of Chlorinated Herbicides in Water, Soils and Wastes	EX45	4/24/02
Zymark Extract Concentration Procedure	EX50	8/8/97
Preparation of SVOA Surrogate and Matrix Spiking Solutions	EX70	11/25/97
Total and Amenable Cyanide: Autoanalyzer Procedure	GE40	8/25/98
Total Cyanide: Autodistillation Procedure	GE41	5/1/98
Midi Distillation of Water and Soils for the Determination of Cyanide	GE43	3/6/98
Organochlorine Pesticides and PCBs	SG45	7/17/98
Graphite Furnace AA	ME75	3/26/98
Semivolatile Compounds by GC/MS	SM05	4/13/98
Extraction and Analysis of Polychlorinated Dibenzo-p-Dioxins and Dibenzofurans by DFLM01.0 including Revision DFLM01.1 and Method 8280A	SAC-ID-0011	10/15/98

Figures

FIGURE 1
EXAMPLE SAMPLE LABEL

SAMPLE LABEL

URS CORPORATION	
Project:	
Project Number:	
Date:	Time:
Sample I.D.	
Preservatives:	
Analysis:	
Samplers:	

SL SAVANNAH LABORATORIES
& ENVIRONMENTAL SERVICES, INC.

OFFICIAL SAMPLE SEAL



SOLUTIA W.G. KRUMMRICH PLANT
SAUGET, ILLINOIS

PROJECT NO.
21561197.00001

URS

DRN. BY: djd 11/26/02
DSGN. BY: at
CHKD. BY:

Example Laboratory Internal Chain
of Custody Form

FIG. NO.
2

2318 MILLPARK DR.
MARYLAND HEIGHTS, MISSOURI 63043
314-429-0100

SHEET ____ of ____

MARYLAND HEIGHTS, MISSOURI 63043
314-429-0100

PROJECT NO:		PROJECT NAME:		NO. OF CONTAINERS	CONTAINER DESCRIPTION / ANALYSES REQUESTED					REMARKS
SAMPLER'S: (Signature)										
DATE	TIME	SAMPLE I.D. NUMBER								
RELINQUISHED BY: (Signature)			DATE / TIME		RECEIVED BY: (Signature)				DATE / TIME	
RELINQUISHED BY: (Signature)			DATE / TIME		RECEIVED AT LAB BY: (Signature)				DATE / TIME	
METHOD OF SHIPMENT:					AIRBILL NO:					

ICP METALS SAMPLE CONTROL LOG

QC Batch #:

Date Digested:

[illegible]

SOLUTIA W.G. KRUMMRICH PLANT
SAUGET, ILLINOIS

PROJECT NO.	21561197.00001
-------------	----------------

URS

DRN. BY: djd 11/26/02
DSGN. BY: at
CHKD. BY:

Example Laboratory Internal Chain of Custody Form

FIG. NO.
4

HEALTH AND SAFETY PLAN RCRA ENVIRONMENTAL INDICATOR FOR CURRENT HUMAN EXPOSURE (CA-725)

W.G. KRUMMRICH PLANT SAUGET, ILLINOIS

Prepared for
W.G. Krummrich Plant
520 Monsanto Avenue
Sauget, Illinois 62206



November 2002

URS

URS Corporation
2318 Millpark Drive
Maryland Heights, MO 63043
(314) 429-0100
Project #21561197.00002

HEALTH AND SAFETY PLAN RCRA ENVIRONMENTAL INDICATOR FOR CURRENT HUMAN EXPOSURE (CA-725)

W.G. KRUMMRICH PLANT SAUGET, ILLINOIS

Prepared for
W.G. Krummrich Plant
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November 2002
URS
URS Corporation
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(314) 429-0100
Project #21561197.00002

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Appendix C	MSDSs for Constituents with Exposure Potential

SECTION ONE

Administrative Information

Client Name: Solutia Inc.
..... Sauget, Illinois

Site Location: W.G. Krummrich Plant
..... Sauget, Illinois

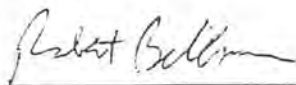
Program Manager: Robert Billman

Project Manager Jeff Adams

Site Safety Officer: Jeff Adams

Effective Dates: November 2002 to December 31, 2003

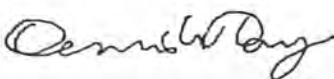
APPROVAL:



Robert Billman
Program Manager

11/25/02

Date



Dennis Day
Regional Health and Safety Manager

11/20/02

Date

SECTION TWO

Introduction

This Health and Safety Plan (HASP) has been developed to provide both general procedures and specific requirements to be followed by URS Corporation (URS) personnel and URS subcontractors while performing sampling activities at the W.G. Krummrich Plant, which is located in Sauget, Illinois. The site location map is shown in **Figure 1**. This HASP describes the responsibilities, training requirements, protective equipment, and standard operating procedures to be used by URS personnel to address potential health and safety hazards while performing the field activities.

URS' Field Sampling Plan (FSP) for the W.G. Krummrich Plant dated November 26, 2002 describes the sampling activities to be performed. This HASP specifies procedures and equipment to be used by URS personnel during work activities and emergency response to minimize URS personnel exposure to hazardous materials.

2.1. IMPLEMENTATION OF THE HASP

The requirements and guidelines presented in this HASP are based on a review of available information and an evaluation of potential on-site hazards. This HASP incorporates by reference the applicable Occupational Safety and Health Administration (OSHA) requirements in 29 CFR Part 1910 29 CFR Part 1926 and EPA Publication 9285.1-03. URS personnel are required to read this HASP before beginning work on-site. This HASP will be available for inspection and review, by URS employees and contractor representatives while work activities are underway. When conducting the sampling activities listed in the FSP, URS personnel will comply with this HASP. On-site URS personnel will notify the URS Site Safety Officer (SSO) of matters of health and safety. The SSO is responsible to the Project Manager for monitoring activities, monitoring compliance with the provisions of this HASP, and for modifying this HASP to the extent necessary if site conditions change (with approval of the Associate for Safety and Health). This HASP is specifically intended for the conduct of activities in the scope of work defined in the FSP. Although this HASP can be made available to interested persons for informational purposes, URS does not assume responsibility for the interpretations or activities of any persons or entities other than employees of URS and URS subcontractors.

SECTION TWO

Introduction

2.2. PROJECT ORGANIZATION

Personnel involved in the activities at this site implicitly have a part in implementing the HASP. Among them, the Project Officer, the Project Manager, the Corporate Associate for Safety and Health, and the SSO/Field Leader have specifically designated responsibilities. Their names and telephone numbers are listed in **Table 1**. Other key URS project personnel, the project's organization, and other primary contacts for the project are presented in the FSP.

Key project personnel and their responsibilities with regard to the HASP are discussed below.

2.2.1 Project Officer

Mr. Robert Billman is the Project Officer. The Project Officer is responsible for the overall administration and technical execution of the project and financial control. The Project Officer is further responsible for the acquisition and delegation of resources necessary for project completion and HASP implementation.

2.2.2 Project Manager

Mr. Jeff Adams is the Project Manager. The Project Manager reports to the Project Officer and is directly responsible for the technical progress and financial control of the project. In addition, the project manager is responsible for project safety including implementing the HASP.

2.2.3 Associate for Safety and Health

Mr. Dennis Day is the URS Regional Health and Safety Manager. Mr. Day will be responsible for review and approval of this HASP and providing safety assistance to the project team. Procedural changes and modifications to this HASP must be approved by Mr. Day. The Regional Health and Safety Manager reviews project plans and revisions to plans to verify that safety and health procedures are maintained throughout the investigation. The SSO audits the effectiveness of the HASP on a continuing basis and suggests changes, if necessary, to the Project Manager.

SECTION TWO

Introduction

2.2.4 Site Safety Officer

Mr. Jeff Adams, or a designee, is the URS Site Safety Officer (SSO) for this investigation. The SSO for URS employees reports to the URS Project Manager, coordinates his activities with the URS Associate for Safety and Health, establishes operating standards, and coordinates overall project safety and health activities for the site.

Specifically, the SSO is responsible for the following actions:

- Providing a complete copy of the HASP to field staff before the start of activities
- Familiarizing workers with the HASP
- Conducting on-site health and safety training and briefing sessions. See **Appendix A** for the Safety Forms.
- Documenting the availability, use, and maintenance of personal protective and other safety or health equipment
- Maintaining safety awareness among URS employees on-site and communicating safety and health matters to them
- Reviewing field activities for performance in a manner consistent with URS' policy and this HASP. See **Appendix B** for URS Safety Management Standards (SMSs)
- Monitoring health and safety conditions during field activities
- Coordinating with emergency response personnel and medical support facilities
- Notifying the Project Manager of the need to initiate corrective actions in the event of an emergency, an accident, or identification of a potentially unsafe condition
- Notifying the Project Manager of an emergency, an accident, the presence of a potentially unsafe condition, a health or safety problem encountered, or an exception to this HASP
- Recommending improvements in safety and health measures to the Project Manager.

SECTION TWO

Introduction

The SSO has the authority to take the following actions:

- Temporarily suspend field activities or otherwise limit exposures if the health or safety of any URS employee appears to be endangered
- Notify URS personnel to alter work practices that the SSO deems to not protect them
- Temporarily suspend an URS employee from field activities for violating the requirements of this HASP.

The tasks to be conducted in the sampling areas include:

- Drilling of soil borings
- Surface and subsurface soil sampling
- Surveying.

The details of these tasks are presented in the FSP and will be conducted in accordance with the procedure outlined in the FSP. Both the potential health and safety hazards and the hazard and contaminant control procedures for each task are discussed below. Based on the available soil and water data, there is a potential for exposure to soil and water constituents as particulates or vapors above the OSHA-permissible exposure level (PEL). Skin contact with impacted soil and liquid should be minimized in accordance with good work practices.

SECTION THREE

Hazard Analysis

Due to dilution and dispersion, the estimated airborne release levels in the breathing zones of site workers are expected to be much lower than source levels. Although the concentration of compounds will decrease with dilution, the proportions within the mix are assumed to remain constant. The proportion of the vapors reaching the breathing zone is thus expected to remain the same as that at the surface of the soil.

There is a potential for exposure to VOCs, SVOCs, herbicides, pesticides, PCBs, dioxins, and metals from the soils. A complete list of known soil contaminants is provided in **Table 2**. Generic Material and Safety Data Sheets (MSDSs) for these materials are attached in **Appendix C**.

A hazard assessment summary of work to be performed on site is available in **Table 3**.

3.1 SURFACE AND SUBSURFACE SOIL SAMPLING

Soil samples will be collected from the surface to a depth of approximately 15 feet using direct push technologies.

3.1.1 Potential Health Hazards and Hazardous Constituents

There is the potential for contact with soil contaminants, the release of organic vapors from the subsurface soil samples, for musculoskeletal injuries when using the geoprobe and bending to collect the samples, and the potential to get dirt in the eyes. Also geoprobes pose a noise hazard and a pinching hazard due to many pinch points on the rig. Other hazards associated with soil sampling include slipping on wet muddy surfaces created by spilled water and electrical hazards associated with the use of electrical equipment around water or wet surfaces.

3.1.2 Hazard and Hazardous Constituent Control

Personnel must wear hard hats and hearing protection when working near operating heavy machinery and will attempt to remain upwind from vehicle exhaust. Before and during soil sampling, air in the general area will be monitored with a photoionization detector (PID), real-time aerosol monitor (RAM), and combustible gas meter (CGM) as described in Section 5.2. Respiratory protection and air monitoring activities will be in accordance with Section 7 of this HASP.

SECTION THREE

Hazard Analysis

A ground fault circuit interrupter will be used in the absence of properly grounded circuitry or when electrical equipment is used in wet conditions. Electrical extension cords used will be protected or guarded from damage and be maintained in good condition.

Back strain can be prevented by employing proper lifting and bailing techniques. Heavy equipment, such as pumps and generators, will only be lifted with the legs, preferably using two or three personnel.

Equipment will be decontaminated in accordance with the guidelines in the QAPP and in Section 9 of this HASP. Decontamination wastes will be collected, drummed, and disposed in accordance with the FSP.

SECTION FOUR

Personnel Training

4.1 SITE WORKERS

URS employees performing the activities listed in the Field Sampling Plan must have completed a training course of at least 40 hours meeting the requirements of 29 CFR 1910.120(e) for safety and health at hazardous waste operations. If the course was completed more than 12 months before the date of site work, completion of an approved 8-hr refresher course on health and safety at hazardous waste operations is required.

Site work must also meet Solutia's contractor safety requirements. URS employees must comply with the URS Safety Management Standards (SMSs) which are provided in **Appendix B**.

4.2 MANAGEMENT AND LEADERS

In addition to the requirements described in section 4.1 for URS site workers, URS field leaders must have completed an off-site training course of at least 8 hours meeting the requirements of 29 CFR 1910.120(e) on supervisor responsibilities for safety and health at hazardous waste operations.

4.3 EMERGENCY RESPONSE PERSONNEL

URS employees who respond as "Good Samaritans" to emergency situations involving health and safety hazards must be trained in how to respond to such emergencies in accordance with the provisions of 29 CFR 1910.120(1). Skills such as cardiopulmonary resuscitation (CPR), mouth-to-mouth rescue breathing, avoidance of blood-borne pathogens, and basic first aid skills may be necessary.

A minimum of one URS on-site individual will be trained in first aid.

4.4 SITE-SPECIFIC TRAINING

Site-specific training will be provided to each URS employee and reviewed before assignment. URS personnel will be briefed daily by the SSO/Field Leader as to the potential hazards that may be encountered during that day. Topics will include:

- Availability of this HASP
- General site hazards and specific hazards in the work areas

SECTION FOUR

Personnel Training

- Selection, use, testing, and care of the body, eye, hand, foot, and respiratory protective equipment being worn and the limitations of each
- Decontamination procedures for URS personnel, their personal protective equipment, and other equipment used on-site
- Emergency response procedures and requirements
- Emergency notification procedures and evacuation routes to be followed
- Procedures for obtaining emergency assistance and medical attention.

4.5 TRAINING CERTIFICATION

A record of employee training completion will be maintained by the SSO for each URS employee who is trained. This record will include the dates of the completion of worker training, supervisor training, refresher training, emergency response training, and site-specific training for on-site URS employees.

4.6 SPECIALIZED TRAINING

URS policy requires 4 hours of additional training to perform work in Level B PPE.

SECTION FIVE

Personnel Protection

The basic level of PPE to be used at the W.G. Krummrich Plant during intrusive and non-intrusive activities is a modification of OSHA Level D. PPE may be upgraded based on air monitoring results or at the discretion of the Project Manager and based on the SSO's recommendations. A downgrade of PPE must be approved by the Associate for Safety and Health and the Project Manager.

If the SSO verifies that field measurements or observations indicate that a potential exposure is greater than the protection afforded by the equipment or procedures specified in this or other sections of this HASP, the work will be stopped, and URS personnel will be removed from the site until the exposure has been reduced or the level of protection has been increased.

URS respirator users have been trained and medically approved to use respiratory protection. Respirators issued are approved for protection against dust and organic vapors by NIOSH. Respirators are issued for the exclusive use of one worker and will be cleaned and disinfected after each use by the worker. Respirator users must check the fit of the respirator before each day's use to see that it seals properly. The respirator must seal against the face so that the wearer receives air only through the air purifying cartridges attached to the respirator. No facial hair that interferes with the effectiveness of a respirator will be permitted on personnel required to wear respiratory PPE. Cartridges and filters for air-purifying respirators in use will be changed daily at a minimum. The user will inspect the integrity of air-purifying respirators daily.

5.1 PROTECTIVE EQUIPMENT DESCRIPTION

The level of PPE is categorized as Level A, B, C, or D, based upon the degree of protection required. The following is a brief summary of the three levels that may be used on this site.

5.1.1 Level B

The concentration(s) and type(s) of airborne substance(s) is unknown and the criteria for not using a totally encapsulating suit are met. The following constitute Level B equipment:

- NIOSH-approved, positive pressure, full-face air supplying respirator or self contained breathing apparatus (SCBA).
- Chemical-resistant clothing
- Coveralls (optional)

SECTION FIVE

Personnel Protection

- Gloves, outer, chemical-resistant (neoprene)
- Gloves, inner, chemical-resistant (nitrile or latex)
- Boots, outer, chemical-resistant, with steel toe and shank or equivalent
- Chemical resistant boot covers (neoprene or butyl rubber)
- Hard hat (Class B)
- Personal flotation device with rope when sampling in water greater than 24 inches deep
- Hearing protection when working in noise hazardous areas, as defined in URS's Quality Assurance Manual
- Tape wrists and ankle joints.

5.1.2 Level C

The concentration(s) and type(s) of airborne substance(s) is known-and the criteria for using air-purifying respirators are met. The following constitute Level C equipment:

- NIOSH-approved, full-face air purifying respirator with organic vapor cartridges and P100 particulate filters
- Chemical-resistant clothing
- Coveralls (optional)
- Gloves, outer, chemical-resistant (neoprene)
- Gloves, inner, chemical-resistant (nitrile or latex)
- Boots, outer, chemical-resistant, with steel toe and shank or equivalent
- Optional chemical resistant boot covers (neoprene or butyl rubber)
- Hard hat (Class B)
- Personal flotation device with rope when sampling in water greater than 24 inches deep
- Face shield and safety glasses when not wearing a full face respirator
- Tape wrists and ankle joints

SECTION FIVE

Personnel Protection

- Hearing protection when working in noise hazardous areas, as defined in URS's Quality Assurance Manual.

5.1.3 Modified Level D

The concentration(s) and type(s) of airborne substance(s) is known and the criteria for not using air-purifying respirators are met. A level of skin protection above Level D is required. The following constitute Modified Level D equipment:

- Tyvek® or equivalent disposable chemical resistant overalls
- Coveralls (optional)
- Gloves, outer, chemical-resistant (neoprene)
- Gloves, inner, chemical-resistant (nitrile or latex)
- Boots, outer, chemical-resistant, with steel toe and shank or equivalent
- Optional chemical resistant boot covers (neoprene or butyl rubber)
- Hard hat (Class B)
- Personal flotation device with rope when sampling in water greater than 24 inches deep
- Face shield and safety glasses
- Hearing protection when working in noise hazardous areas, as defined in URS's Quality Assurance Manual.

5.1.4 Level D

A work uniform affording minimal protection, used, for nuisance contamination only. The following constitute Level D equipment:

- Long-sleeve shirt
- Gloves (neoprene or leather)
- Boots or shoes, leather, steel toe and shank
- Optional chemical resistant boot covers (neoprene or butyl rubber)
- Safety glasses or chemical splash goggles

SECTION FIVE

Personnel Protection

- Hard hat (Class B)
- Personal flotation device with rope when sampling in water greater than 24 inches deep
- Escape mask (optional)
- Face shield when not wearing other eye protection.
- Hearing protection when working in noise hazardous areas, as deemed in URS's Quality Assurance Manual.

5.2. PROTECTIVE EQUIPMENT SELECTION

Levels of PPE will be as shown in the following table:

<u>Activity</u>	<u>Level B</u>	<u>Level C</u>	<u>Modified Level D</u>	<u>Level D</u>
Surface and subsurface soil sampling		Upgrade	Initial	

5.3 PROTECTIVE EQUIPMENT FAILURE

If an individual experiences a failure or other alteration of PPE that may affect its protective ability, that person is to leave the work area immediately. The Project Manager or the SSO must be notified and, after reviewing the situation, is to evaluate the effect of the failure on the continuation of on-going operations. If the Project Manager or the SSO ascertains that the failure affects the safety of workers, the work site, or the surrounding environment, workers are to be evacuated until corrective actions have been taken. The SSO will not allow re-entry until the equipment has been repaired or replaced and the cause of the failure has been identified.

SECTION SIX

Medical Monitoring

6.1 MEDICAL SURVEILLANCE PROGRAM

URS has implemented a medical monitoring program in accordance with 29 CFR 1910.120. The URS program is designed to monitor and reduce health risks to employees potentially exposed to hazardous materials and to provide baseline medical data for each employee involved in work activities. It is also designed to evaluate the employee's ability to wear PPE such as chemical-resistant clothing and respirators.

Medical examinations are administered on a post-hire and annual basis and as warranted by symptoms of exposure or specialized activities. The post-hire examination provides baseline data. The examining physician is required to make a report to URS of any medical condition that would increase the employee's risk when wearing a respirator or other PPE. URS maintains site personnel medical records as required by 29 CFR 1910.120, as applicable.

URS employees performing the activities listed in the FSP or this document have or will receive medical tests as regulated by 29 CFR 1910.120. Where medical requirements of 29 CFR 1910.120 overlap those of 29 CFR 1910.134 or 29 CFR 1910.1025, the more stringent standard will be enforced.

Solutia requires substance abuse testing, and documentation of test results is required prior to work at the facility.

6.2 RESPIRATOR CERTIFICATION

Employees who wear or may wear respiratory protection have been provided respirators as required by 29 CFR 1910.134. This standard requires that an individual's ability to wear respiratory protection be medically certified before performing designated duties.

SECTION SEVEN

Air Monitoring

The air will be monitored in the breathing zone with a PID and a RAM to assess the presence and concentration of organic vapor and airborne dusts (respectively) during drilling and sampling activities. The air will be monitored with a CGM during intrusive work to detect the presence of combustible concentrations of materials. The monitoring strategies described below may change if work tasks or operations change. Monitoring instruments will be checked for appropriate response, in accordance with the manufacturer's instructions, before use each sampling day.

Action levels are used to ascertain when activities should stop, when site evacuation is necessary, to select emergency response levels, and to change PPE levels.

7.1 ORGANIC AND INORGANIC VAPORS

There is the potential for hazardous materials to be present at the W.G. Krummrich Plant at levels that will pose a health hazard to workers. Real time monitoring of organic vapors will be conducted on-site by, or under the supervision of the SSO, to evaluate the concentrations of organic vapors and site-generated dusts. The SSO will evaluate whether the personal protective measures employed during field activities are appropriate and will modify the protective measures accordingly. Field personnel will record equipment calibrations, repairs, and readings in a notebook that is a part of the site log. The SSO will be responsible to maintain monitoring instruments throughout the investigation.

7.1.1 Photoionization Detector (PID)

A PID monitors the air for many organic and some inorganic gases and vapors. A portable PID equipped with a 10.2 electron volt detector, as appropriate, will be used during the project to assess the presence and concentration of VOCs. Ionization potential tables are included in **Table 2** for reference. Air will be monitored in the breathing zone of the URS worker at approximately five-minute intervals. The PID will be checked for positive and accurate response to a pre-established concentration of isobutylene in accordance with the manufacturer's instructions before use each sampling day.

Before the start of work, the PID will be used to assess the concentration of VOCs upwind from the work area. When VOC levels exceed the action level, the PID will be used to measure the VOC level downwind from the work area.

The batteries will be recharged or replaced daily and the lamp window will be cleaned regularly.

SECTION SEVEN

Air Monitoring

7.1.2 Action Levels

Organic vapors may be liberated from the soil during site activities. A PID will be used to assess the presence of total organic vapors.

There is a potential for exposure to VOCs, SVOCs, PCBs, dioxins, pesticides, herbicides, and metals from the soils. A complete list of known contaminants is provided in **Table 2**. Generic MSDSs for these materials are attached in **Appendix C**.

If not already in Level C PPE, an air purifying respirator and chemical resistant clothing will be donned by employees when VOC concentrations of 1 ppm or more are sustained above background in the breathing zone for 5 minutes. Colorimetric tubes will be used to measure benzene concentrations in the breathing zone at sustained levels of 1 ppm VOCs. Work may continue until the measured VOC concentration is greater than or equal to 25 ppm or benzene levels exceed 10 ppm on a consistent basis. At that time, the workers will leave that work area or upgrade. Actions, such as increasing ventilation, may be implemented to promote dispersion of the vapors.

ACTION LEVEL TABLE

Analyzer Reading*	Location	Duration	Action	Personal Protective Equipment
VOC < 10 ppm	Point of Operations/ Release Source point	—	Continue periodic monitoring.	Modified Level D
VOC > 10 ppm Benzene > 1 ppm	OBZ	>1 minute	Provide respiratory protection.	Level C
VOC > 25 ppm Benzene > 10 ppm	OBZ	>1 minute	Stop Work	Stop Work.

(OBZ - Operator's Breathing Zone)

SECTION SEVEN

Air Monitoring

7.2 PARTICULATES

7.2.1 Real Time Aerosol Monitor (RAM)

A RAM monitors the total dust concentration in the air. A RAM will be used to assess the presence and concentration of respirable dust during field activities. During drilling, if wet methods are not used, monitoring in the breathing zone of the URS worker will be performed at approximately five-minute intervals. The RAM will be checked, in accordance with the manufacturer's operating instructions, prior to use each sampling day for appropriate responses.

The batteries will be recharged or replaced daily and the desiccant will be replaced when necessary. The RAM will be checked, in accordance with the manufacturer's instructions, for appropriate responses prior to each use.

7.2.2 Action Levels

There is the potential for exposure to arsenic, barium, beryllium, cadmium, copper, dioxin, lead, selenium and vanadium in the dust generated during activities on the site. Generic MSDSs for these materials are attached in **Appendix C**. A total dust action level of 0.03 mg/m^3 ($30 \text{ }\mu\text{g/m}^3$) has been established.

When respirable particulates are detected at 0.03 mg/m^3 or greater, a full-face respirator with P100 filters will be worn, if the employee is not already in Level C. Employees will leave the work area when the respirable dust concentration exceeds 1 mg/m^3 . Dust suppression techniques (e.g., water application and activity controls) may be implemented to reduce the generation of dust.

Upon visual observation of air-borne particulate matter associated with on-site activities, a water spray will be applied as a control measure. If a water spray cannot be applied, additional personal monitoring will be undertaken to assess whether correct personal protective measures are being taken.

7.3 COMBUSTIBLE GAS VAPORS

7.3.1 Combustible Gas Monitor (CGM)

A CGM measures the concentration of combustible gases or vapors. A portable CGM will be used continuously to assess the presence and concentration of combustible gases and vapors

SECTION SEVEN

Air Monitoring

during intrusive activities. The CGM will be programmed to sound an alarm when the combustible gas concentration exceeds 20% of the lower explosive limit (LEL) for methane. During trench excavation, the CGM will be programmed to respond at 10% of the LEL. The CGM will be checked for appropriate response, in accordance with the manufacturer's instructions, before use each sampling day.

The batteries will be recharged or replaced daily and the CGM calibrated immediately before use.

7.3.2 Action Levels

Explosive levels of gases and vapors may accumulate in wellheads and low locations on the site. A CGM will be used during intrusive work to assess the level of combustible gas. An action level of 20% of the LEL for methane will be used for work outside of trenches. An action level of 10% of the LEL will be used during trench excavations. Work will cease at any location where the explosive gas reading exceeds the action level. Actions, such as increasing ventilation, will be taken to disperse the combustible gas from that area. If the combustible gas level does not decrease within 10 minutes, the SSO will contact the Fire Department for assistance. Although personnel are not required to vacate the area until the LEL reaches the action level (10% or 20%), they may not return until the LEL is below 5% or 15%, respectively.

SECTION EIGHT

Site Control

8.1 SITE SECURITY

Site security will be monitored and controlled by the Project Manager, and the SSO/Field Leader. Their duties will include limiting access to the work area to authorized personnel, maintaining a sign-in roster, overseeing project equipment and materials, and overseeing work activities. The procedures specified below will be followed to control access to each work site to prevent persons who may be unaware of site conditions from exposure to hazards. Work area control procedures may be modified as required by activity and site conditions. Site security will be established on a site- and activity-specific basis.

8.2 SITE CONTROL

An exclusion zone and a contamination reduction zone will be established by the SSO/Field Leader at each sampling and drilling point. A map depicting the exclusion zone, contamination reduction zone, and support zone will be prepared and posted in the support zone. The layout of the zones, the procedures to be followed for zone control, and the signs used to indicate the zones will be reviewed during the daily safety briefings before beginning the day's work. The general area of the zones for each day will be identified by the SSO/Field Leader during the daily site briefing. This information will be included in the daily site log.

8.2.1 Exclusion Zone

The exclusion zone is where sampling and observation of drilling activities are conducted. The SSO will identify this zone. It should be at least 30 ft in diameter and centered, when possible, on the work activities. This zone will be designated with flagging or equivalent attached to portable stakes or cones installed before beginning the fieldwork. The zone may be enlarged to contain the necessary ancillary equipment and personnel for the work to be done.

8.2.2 Contamination Reduction Zone

The contamination reduction zone (CRZ) contains personnel and equipment decontamination stations. The CRZ will be located upwind from the work activities. It will only be large enough to contain equipment and personnel necessary to keep potentially impacted media and materials in the immediate work area. This area will be designated with flags attached to portable stakes or cones. The CRZ will be established on the day site work commences within a particular exclusion zone, based on the direction of the wind on that day.

SECTION EIGHT

Site Control

8.2.3 Support Zone

The support zone contains support facilities, extra equipment, transport vehicles, and additional personnel and equipment necessary to manage and perform work activities.

8.3. SITE ACCESS PROCEDURES

URS personnel, subcontractors and regulatory personnel will sign in and out of the job site every day. URS personnel leaving an exclusion zone will be decontaminated in a contamination reduction zone before entering the support zone.

8.4. SITE COMMUNICATIONS

Portable communications, e.g., radios, cellular phones, etc. will be used during activities to facilitate communications for emergency response and other purposes and to serve as the primary off-site communication network. Telephones located at the W.G. Krummrich Plant will provide back up for the portable phones.

8.5. CONFINED SPACE ENTRY

Entry of permit-required confined spaces will not occur during this project.

SECTION NINE

Decontamination

9.1 PERSONNEL DECONTAMINATION PROCEDURES

Sampling activities will occur in widely separated locations. For this reason, equipment and personnel decontamination will be done at each sampling area, using temporary facilities. The SSO will be responsible for supervising the proper use and decontamination of equipment and PPE.

Decontamination involves scrubbing with a soap and water solution followed by rinses with potable water. Decontamination will take place on a decontamination pad. Dirt, oil, grease, or other foreign materials that are visible will be removed from surfaces. Scrubbing with a brush may be required to remove materials that adhere to the surfaces. Splash protection garments will be washed with soap and potable water before removal. Non-disposable garments will be air-dried before storage. Wastewaters from personnel decontamination will be disposed of with the wastewaters from equipment decontamination. Respirators will be sanitized as well as decontaminated each day before re-use. The manufacturer's instructions will be followed to sanitize the respirator masks.

The following decontamination protocol, or one providing the same level of decontamination, will be followed:

Provide a table covered with a plastic drop cloth. Deposit equipment used on site, including tools, sampling devices and containers, monitoring instruments, radios, and clipboards, on the table.

Establish a wash station for gloves, boots, and the protective suit (when worn). Scrub outer boots, outer gloves, and protective suit with detergent and water. Rinse with potable water.

If the garment is disposable, deposit it in a container with a plastic liner; otherwise, hang it up to air dry.

Remove and dispose of gloves. Deposit them in a container with a plastic liner. If the gloves are to be reused, place them in a secure location near the work site, preferably in a plastic container.

9.2 EQUIPMENT DECONTAMINATION PROCEDURES

The PID, RAM and CGM used for health monitoring purposes will be cleaned of visible contamination and debris before initial use on-site, between uses, and after final use. Monitoring equipment that contacts impacted media will be decontaminated after each use by a low-

SECTION NINE

Decontamination

phosphate detergent brushing followed by a clean water rinse. After decontamination, monitoring equipment will be stored separately from PPE.

All drilling equipment will be decontaminated prior to commencing field activities, between sample locations, and prior to demobilizing from the site.

Decontaminated or clean equipment not in use will be covered with plastic and stored in a designated storage area in the support zone.

9.3 DECONTAMINATION SUPPLIES

The following supplies will be available on-site as needed for the decontamination of personnel and equipment:

- Plastic drop cloths
- Plastic wash tubs
- Soft bristled long-handle brushes
- DOT-approved drums in which to collect wash and rinse water
- Hand spray units for decontamination
- Soap, water, alcohol wipes, and towels to wash hands, faces, and respirators
- Washable tables and benches or chairs.

9.4 COLLECTION AND DISPOSITION OF IMPACTED MATERIALS AND REFUSE

Cuttings, purge waters, and field decontamination wastes will be collected at the point of generation and stored in temporary containers. Disposable PPE, solids, and liquids will be consolidated in separate bulk containers at a central area.

SECTION TEN

Emergency Response

10.1 NOTIFICATION OF SITE EMERGENCIES

In an emergency, site personnel will signal distress either verbally or with three blasts from a horn (vehicle horn, air horn, and so forth). The SSO/Field Leader or the Project Manager will immediately be notified of the nature and extent of the emergency. **Table 1** contains emergency telephone numbers. This table will be kept with the portable telephone and updated as needed by the SSO. The portable telephone will be used to notify off-site personnel of emergencies. The operating condition of this telephone will be verified daily before initiation of activities.

A map showing the location and the route to St. Mary's Hospital is included **Figure 2**. Directions to St. Mary's Hospital from the site are as follows:

From the W.G. Krummrich Plant, drive west on Monsanto Avenue to Illinois State Route 3, North (IL 3 N). Drive north on IL 3 N. Take the 170 east/I 64 East/I 55 North exit toward Chicago/Indianapolis. Take the 4th St Exit toward Business District/East St. Louis. Merge onto south 4th Street, turn right onto east Broadway/IL 15. Turn left onto north 8th Street. St. Mary's Hospital is located at 129 North 8th Street. The distance from the site to the hospital is approximately three miles. The estimated driving time is seven minutes.

A copy of this HASP will be available to St Mary's Hospital and to the Cahokia and Sauget Fire and Police departments if necessary. Should someone be transported to a hospital or doctor other than at St. Mary's Hospital, a copy of this HASP should accompany him/her.

10.2 RESPONSIBILITIES

The SSO is responsible for responding to, or coordinating the response of off-site personnel to emergencies. In the event of an emergency, the SSO/Field Leader will direct notification and response, and arrange follow-up actions. Upon notification of an exposure incident, the SSO will call 911 and request that hospital, fire, and police emergency response personnel recommend medical diagnosis or treatment if necessary, and provide transportation to the hospital. The SSO/Field Leader will contact local, state, and federal government agencies, as appropriate.

SECTION TEN

Emergency Response

Before the start of remedial action activities, the SSO will:

1. Notify emergency contacts, and health care facilities of the potentially hazardous activities on-site as a result of the activities listed in the Field Sampling Plan.
2. Have a working knowledge of the URS safety equipment.
3. Confirm that a map detailing the most direct route to St. Mary's Hospital (**Figure 2**) is prominently posted with the emergency telephone numbers (**Table 1**).
4. Confirm that employees who will respond to emergencies have been appropriately trained.
5. Collect and maintain a file of MSDS for materials used at the site during the remedial action activities. The MSDSs are provided in **Appendix C**.

Before work may resume following an emergency, used emergency equipment must be recharged, refilled, or replaced and government agencies must be notified as required.

The Project Manager, assisted by the SSO/Field Leader, must investigate the incident as soon as possible. The Project Manager will assess whether and to what extent exposure actually occurred, the cause of exposure, and the means to prevent similar incidents. The resulting report must be signed and dated by the Project Manager and Regional Health and Safety Manager.

10.3 ACCIDENTS AND INJURIES

In the event of an accident or injury, workers will immediately implement emergency isolation measures to assist those who have been injured or exposed and to protect others from hazards. Upon notification of an exposure incident, the SSO will contact emergency response personnel who can provide medical diagnosis and treatment. If necessary, immediate medical care will be provided by personnel trained in first aid procedures. Other on-site medical or first aid response to an injury or illness will be provided only by personnel competent in such matters.

SECTION TEN

Emergency Response

10.4 SAFE REFUGE

Before commencing site activities, a place of refuge for URS workers will be identified by the SSO. In case of an emergency, personnel in the exclusion zone should evacuate the work area both for their own safety and to prevent hampering rescue efforts. Following an evacuation, the SSO will account for site personnel. If evacuation from the on-site refuge location is necessary, the project vehicles will be used to transport personnel to the place of refuge.

10.5 FIRE FIGHTING PROCEDURES

A fire extinguisher meeting the requirements of 29 CFR Part 1910 Subpart L, as a minimum, will be available in the support zone during on-site activities. This is intended to control small fires. When a fire cannot be controlled with the extinguisher, the exclusion zone will be evacuated, and the fire department will be contacted immediately. The SSO/Field Leader will decide when to contact the fire department.

10.6 EMERGENCY EQUIPMENT

The following equipment, selected based on potential site hazards, will be maintained in the support zone for safety and emergency response purposes:

- Fire extinguisher
- First aid kit
- Eye wash bottles.

10.7 EMERGENCY SITE COMMUNICATIONS

Hand and verbal signals will be used at the W.G. Krummrich Plant for emergency communications.

10.8 SECURITY AND CONTROL

Work zone security and control during emergencies, accidents, and incidents will be monitored by the SSO/Field Leader. The duties of the SSO/Field Leader include limiting access to the work zones to authorized personnel and overseeing emergency response activities.

SECTION ELEVEN

Special Precautions and Procedures

The activities listed in the Field Sampling Plan may expose personnel to both chemical and physical hazards. The hazards associated with specific site activities are discussed in Section 2. The potential for exposure to hazardous situations will be significantly reduced through the use of air monitoring, PPE, hazard awareness, training, and administrative and engineering controls. Other general hazards that may be present on a hazardous waste work site are discussed below.

11.1 HEAT AND COLD STRESS

The timing and location of this project may be such that heat stress could pose a threat to the health and safety of site personnel. The SSO will have a dry bulb thermometer on site and use it to implement work and rest regimens so that URS personnel do not suffer adverse effects from heat. Special clothing and an appropriate diet and fluid intake will be recommended to URS personnel involved in the activities specified in Section 2 to further reduce this hazard. In addition, ice and fluids will be provided as appropriate in the support zone.

Exposure to cold or wet and cold environments can result in cold stress (hypothermia) or cold injury (frostbite). Adequate clothing to protect from the environment is recommended to URS personnel. Symptoms of exposure are described below.

- **Frostbite** - toes, fingers, cheeks, and ears are most commonly affected; uncomfortable feeling of coldness and numbness; tingling, stinging, or cramping; blanching or whitening of the skin, may have a waxy appearance and is firm to the touch; blistering or peeling of frozen skin will follow exposure.
- **Hypothermia** - results when the body loses heat faster than it can be produced and the internal temperature drops. Exposure symptoms will follow a general pattern as the body temperature decreases: involuntary shivering, speech difficulty, confusion, loss of manual dexterity and coordination; dilated pupils that react to light; shivering ceases; body temperature at 89.6°F there is a progressive loss of consciousness, muscular rigidity, decreased respiration; collapse, unconsciousness, respiratory and cardiac failure.

A detailed discussion is presented as SMS 18 in **Appendix B**.

SECTION ELEVEN

Special Precautions and Procedures

11.2 HEAVY MACHINERY / EQUIPMENT

URS employees performing site activities may use or work near operating heavy equipment and machinery. Respiratory protection, hearing protection, and protective eyewear may be worn during portions of work activities. Since this protective equipment narrows the visual and acoustic environment of the wearer, URS personnel should exercise extreme caution in the vicinity of operating equipment and machinery to avoid physical injury to themselves or others.

A detailed discussion is presented as SMS 19 in **Appendix B**.

11.3 ADDITIONAL SAFETY PRACTICES

The following are important safety precautions that will be enforced during the completion of the activities listed in Section 2:

1. URS will not conduct operations during severe weather. The SSO/Field Leader will decide when severe weather conditions exist or are forecast and take actions appropriate to the site and the anticipated severe weather to minimize the potential exposure of URS employees.
2. URS employees will refrain from unnecessary contact with plants, animals, and other biological hazards on the site. Should contact occur, the employee must report it to the SSO/Field Leader and the Corporate Associate for Safety and Health, following the procedures in Vol. 3 of the URS Quality Assurance Manual, Sections. 001 and 017.
3. Eating, drinking, chewing gum or tobacco, smoking, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material is prohibited in the exclusion zone and contamination reduction zones.
4. Hands and face must be thoroughly washed when leaving the support zone and before eating or drinking.
5. Contact with potentially impacted surfaces should be avoided whenever possible. Workers should minimize walking through puddles, mud, or other discolored surfaces; kneeling on ground; and leaning, sitting, or placing equipment on drums, containers, vehicles, or the ground.
6. Medicine and alcohol can mask the effects of exposure to certain compounds. Consumption of prescribed drugs must be at the direction of a physician.

SECTION ELEVEN

Special Precautions and Procedures

7. URS personnel and equipment in the work areas will be minimized consistent with effective site operations.
8. Unsafe or inoperable equipment left unattended will be identified by a "DANGER, DO NOT OPERATE" tag.
9. Activities in the exclusion zone will be conducted using the "Buddy System." The Buddy is another worker fully dressed in the appropriate PPE who can perform the following activities:
 - Provide partner with assistance
 - Observe partner for sign of chemical or heat / cold exposure and integrity of PPE
 - Notify others if emergency help is needed.
10. The HASP will be reviewed frequently for its applicability to the current and upcoming operations and activities.

11.4 DAILY LOG CONTENTS

The Project Manager and the SSO will establish a system appropriate to the W.G. Krummrich Plant that will record, at a minimum, the following information:

1. URS personnel and other personnel conducting the site activities, their arrival and departure times, and their destination at the site
2. Incidents and unusual activities that occur on the site such as, but not limited to, accidents, breaches of security, injuries, equipment failures, and weather related problems
3. Changes to the Field Sampling Plan and the HASP
4. Daily information such as:
 - Work accomplished and the current site status
 - Air monitoring equipment calibrations, repairs, and results.
 - Site work zones.

SECTION TWELVE

References

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- S Marlowe, Christopher CIII. Camp Dresser & McKee, May 1994. "Action Levels for Hazardous Waste Site Work." NIOSH, OSHA, USCG, EPA Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities, DHHS (NIOSH) Publication No. 85-115, October 1985
- URS Corporation. November 2002. *Field Sampling Plan. RCRA CA-725 Environmental Indicators Human Exposures.*
- URS Corporation. November 2002. *Quality Assurance Project Plan. W.G. Krummrich Plant. Sauget, Illinois.*
- United States Environmental Protection Agency, *Health and Safety Plan (HASP) Users Guide*, Publication EPA 9285.8-01, July 1993
- United States Environmental Protection Agency, *Standard Operating Safety Guides*, Publication EPA 9285.1-03, June 1992
- 29 CFR. 19 10.120 Hazardous Waste Operations and Emergency Response
- 29 CFR 19 10.146 Permit-Required Confined Spaces

Tables

TABLE 1
EMERGENCY RESPONSE CONTACTS

Effective Date: November 2002 Expiration Date: _____

External Emergency Telephone Numbers

Telephone Numbers

Sauget Fire Department	911 or 618/332-6700
Cahokia Fire Department.....	618/337-5080
Sauget Police Department.....	911 or 618/332-6507 or 6997
Cahokia Police Department.....	618/337-9505
St. Claire County Sheriff.....	911 or 618/277-3500
Illinois State Police	618/346-3990 (District 11)
St. Marys Hospital (East St. Louis, IL)	618/274-1900
(Emergency/Trauma Center)	
Ambulance Service	911
Poison Control Center.....	800/942-5969
National Response Center Washington, D C.....	800/424-8802

URS Telephone Numbers

Robert Billman.....	314/429-0100 (office)
Project Officer.....	314/308-2877 (cellular)
Jeff Adams	314/429-0100 (office)
Project Manager	314/409-6460(cellular)
Dennis Day	402/334-8181 (office)
Associate for Safety and Health.....	402/659-5437 (cellular)
Phil Jones	215/542-3800
URS Corporate Health & Safety Director	

Facility Telephone Numbers

Robert Hiller	
Solutia Inc.	618/482-6362 (office)

Table 2. W.G. Krummrich Plant Site-Specific Potential Chemical Hazards (Compound list taken from historical data)

Contaminant	Highest Observed Soil Concentration	PEL/TLV (TWA unless noted)	IDLH	Warning Concentration	Symptoms/Effects of Acute Exposure	Photo Ionization Potential	L.E.L. %	U.E.L. %
Volatile Organic Compounds (VOCs)								
Acetone	460 ug/kg	PEL=1000 ppm TLV= 500 ppm	2500 ppm	100 ppm	Irritable eyes, nose, throat; head, dizziness, CNS depression, derm	9.69 eV	2.5	12.8
Benzene	1,200,000 ug/kg	PEL=1 ppm TLV=0.5 ppm	500 ppm	4.68 ppm	Irritable eyes, skin, nose, respiratory system, headaches, nausea, staggered gait, dermatological, bone marrow depression	9.25 eV	1.2	7.8
Chlorobenzene	30,000,000 ug/kg	PEL=75 ppm TLV=10 ppm	1000 ppm	0.21-60 ppm	Irritable eyes, skin, nose, drowsiness, incoherent, CNS depression	9.07 eV	1.3	9.6
Chloroform	40 ug/kg	C 50 ppm	Ca (500 ppm)	Ceiling level	Irritated eyes, skin dizziness, nausea	11.42 eV	NA	NA
Carbon disulfide	16 ug/kg	PEL:20 ppm REL: 1 ppm	500 ppm	sweet-like ether odor*	dizziness, head, poor sleep, low-weight, psychosis, Parkinson-like syndrome	10.08 eV	1.3	50.0
Dichloromethane	350 ug/kg	PEL=25 ppm TLV=50 ppm	2300 ppm	25-320 ppm	Irritable eyes, skin, weakness, light-headed, Numb, tingling limbs, nausea	11.35 eV	13	23
Ethylbenzene	3,300,000 ug/kg	PEL = 100 ppm	800 ppm	0.25 – 200 ppm Aromatic odor	Eye, skin and mucus membrane irritation; headache; dermatitis; narcosis; coma.	8.76 eV	0.8	6.7
Isopropylbenzene	29 ug/kg	50 ppm	900 ppm		Irritated eyes, skin, mucous membrane, headache	8.75 eV	0.9	6.5
Tetrachloroethene	830 ug/kg (S)	PEL=100 ppm	150 ppm	4.68-50 ppm	Irritable eyes, nose, throat, nausea, flushed face, neck, vertigo, dizziness, incoherent, headache	9.32 eV	NA	NA
Toluene	220,000 ug/kg	PEL = 200 ppm	500 ppm	0.17 – 40 ppm Aromatic odor like benzene. Sweet, pungent fatigue (300-400 ppm).	Eye, nose irritation, fatigue, weakness; confusion; euphoria, dizziness, headache; dilated pupils, shedding tears, nervousness, muscle fatigue, insomnia, paresthesia, dermatitis, liver and kidney damage.	8.82 eV	1.1	7.1
Trichloroethene	4.4 ug/kg	100 ppm	Ca (1000 ppm)		Irritated eyes, skin, and nose, drowsiness	9.45 eV	8	10.5
Trichlorofluoromethane	1,600,000	1000 ppm	2000 ppm	odorless	Incoherence, tremor, dermatitis, cardiac arrhythmia	11.77 eV	NA	NA
Vinyl chloride	10 ug/kg	1 ppm	Ca (ND)		weakness, abdominal pain	9.99 eV	3.3	33
m&p-Xylene	15,000,000 ug/kg	100 ppm	900 ppm	aromatic odor	irritated eyes, skin, nose, throat, dizziness, excitement, drowsiness, incoherence	8.56 eV	1.1	7.0
o-xylene	38,000,000	100 ppm	900 ppm	aromatic odor	irritated eyes, skin, nose, throat, dizziness, excitement, drowsiness, incoherence	8.56 eV	0.9	6.7
Xylene	1,600,000 ug/kg	PEL = 100 ppm	900 ppm	1.1 – 3.7 ppm Aromatic odor	Eye, skin, nose, and throat irritation; dizziness; excitement, drowsiness, incoordination, staggering gait; nausea, vomiting, abdominal pain; dermatitis.	8.56 eV	0.9	6.7
Semi-Volatile Organic Compounds (SVOCs)								
Anthracene	1200 ug/kg	NA	NA	NE	Irritation of the eyes and respiratory tract and gastrointestinal tract if swallowed.	NA	0.6	NA
bis(2-ethylhexyl)phthalate	1800 ug/kg							

Table 1. W.G. Krummrich Plant Site-Specific Potential Chemical Hazards (Continued)

Contaminant	Highest Observed Soil Concentration	PEL/TLV (TWA unless noted)	IDLH	Warning Concentration	Symptoms/Effects of Acute Exposure	Photo Ionization Potential	L.E.L. %	U.E.L. %
Benzo(a)Anthracene	1900 ug/kg	NA	NA	NE	NA	7.53 eV	NA	NA
Benzo(b)Fluoranthene	2400 ug/kg	TLV = 0.2 mg/m ³	NE	NE	skin tumors in laboratory animals	NA	NA	NA
Benzo(g,h,i)perylene	1800 ug/kg	NA	Ca	NA	NA	NA	NA	NA
Benzo(a)Pyrene	2200 ug/kg	TLV = 0.2 mg/m ³	NE	Faint aroma	mucous membrane irritation, dermatitis, bronchitis, cough, dyspnea, conjunctivitis, photosensitization, pulmonary edema.	NA	NA	NA
Benzo(k)fluoranthene	730 ug/kg	NA	NE	NA	NA	NA	NA	NA
Chrysene	2100 ug/kg	PEL = 0.2 mg/m ³	NE	NA	Skin irritation; dermatitis; respiratory irritation; dyspnea; mucous membrane	7.59 eV	NA	NA
Dibenzo(a,h)anthracene	540 ug/kg	PEL = 0.2 mg/m ³	NE	NA	Skin irritation	NA	NA	NA
2,4-Dichlorophenol	130 ug/kg	NA	NA	NA	NA	NA	NA	NA
Di-n-octyl phthalate	3,900 ug/kg (S)	NA	NE	NA	Irritation of the eyes, skin, mucous membranes, nasal irritation, laryngeal irritation, respiratory irritation, dermatitis, erythema, kidney and liver damage, weight loss, respiratory distress and dyspnea.	NA	NA	NA
Fluoranthene	2800 ug/kg	NA	NE	NA	NA	NA	NA	NA
Fluorene	560 ug/kg	NA	NE	NA	NA	NA	NA	NA
Hexachlorobutadiene	260 ug/kg (S)	NIOSH = 0.01 ppm	NE	Mild turpentine odor	Irritation of the skin, eyes, mucous membranes and lungs; liver and kidney damage; and CNS effects.	NE	NE	NE
Indeno(1,2,3-cd)pyrene	2200 ug/kg	NA	NE	NA	NA	NE	NE	NE
Naphthalene	6,900 ug/kg (S)	TWA = 10 ppm PEL = 10 ppm	250 ppm	0.003-0.3 ppm	Irritant to eyes; excitement; confusion; abdominal pain; sweating; optical neuritis; headache; nausea; vomiting; jaundice; salivate; renal shutdown.; hematuria	8.12 eV	0.9	5.9
Pentachlorophenol	1,900,000 ug/kg	0.5 mg/m ³ (skin)	2.5 mg/m ³	NA	Irritated eyes, nose, throat, sneeze, cough	NA	NA	NA
Phenol	1700 ug/kg	5 ppm (skin)	250 ppm	sweet acrid odor	Irritated eyes, nose, throat, muscle ache	8.5 eV	1.8	8.6
Pyrene	3800 ug/kg	PEL = 0.2 mg/m ³		NA	Poison by inhalation. Moderately toxic by ingestion. A skin irritant.	7.72 eV	NA	NA
Phenanthrene	4,700 ug/kg	PEL = 0.2 mg/m ³	80 mg/m ³	NA	Dermatitis, bronchitis. Moderately toxic by ingestion..	7.8 eV	NA	NA
2,4,6-Trichlorophenol	1200 ug/kg	NA	NA	NA	NA	NA	NA	NA
Inorganics								
Aluminum	15500 mg/kg	15 mg/m ³ (total), 5 mg/m ³ (resp)	ND		Irritated eyes, skin, respiratory system	NA	NA	NA
Antimony	8 mg/kg	PEL = 0.5 mg/m ³	50 mg/m ³	NA	Eye, nose throat, mouth irritation; cough; dizziness; headache; nausea, vomiting, diarrhea; cramps, skin irritation.	NA	NA	NA
Arsenic	12.4 mg/kg	PEL = 0.010 mg/m ³	5 mg/m ³	1 ppm odorless	Ulceration of nasal septum, dermatitis, gastro-intestinal disturbances, peripheral neuropathy, respiratory irritation	NA	NA	NA
Barium	246 mg/kg	PEL = 0.5 mg/m ³	50 mg/m ³	NA	Eye, skin irritation, upper respiratory	NE	NA	NA

Table 1. W.G. Krummrich Plant Site-Specific Potential Chemical Hazards (Continued)

Contaminant	Highest Observed Soil Concentration	PEL/TLV (TWA unless noted)	IDLH	Warning Concentration	Symptoms/Effects of Acute Exposure	Photo Ionization Potential	L.E.L. %	U.E.L. %
					irritation, skin burns, gastroenteritis, muscle spasm, slow pulse.			
Beryllium	1.2 mg/kg	TLV=0.0002 mg/m ³	4 mg/m ³ Ca	NA	chest pain, cough, cyanosis, pulmonary insufficiency; irritation eyes; dermatitis	NA	NA	NA
Cadmium	7.5 mg/kg	NIOSH lowest possible	9 mg/m ³	Inadequate	Pulmonary edema, dyspnea, cough, tight chest substernal pain; headache; chills, muscle aches; nausea, vomiting, diarrhea.	NA	NA	NA
Chromium	36.9 mg/kg	PEL = 0.5 mg/m ³	250 mg/m ³ (Cr(II))	Odorless	Eye irritation, dermal sensitization.	NA	NA	NA
Cobalt	12.2 mg/kg	PEL=0.1 mg/m ³	20 mg/m ³	Odorless	Cough, dyspnea, wheezing, decreased pulmonary function, weight loss, dermatitis, diffuse nodular fibrosis.	NA	NA	NA
Copper (Total)	305 mg/kg	TLV=1 mg/m ³	100 mg/m ³	odorless	Long-term exposure to copper in the air can irritate your nose, mouth, and eyes, and cause dizziness, headaches, and diarrhea, skin irritation or rash	NA	NA	NA
Lead	567 mg/kg	PEL = 0.050 mg/m ³	100 mg/m ³		Weakness, lassitude, insomnia, pallor, pale eye, anorexia, weight loss, malnutrition, constipation, abdominal pain, colic, anemia, gum lead line, paralysis.	NA	NA	NA
Mercury (Total)	1.1 mg/kg	Ceiling = 0.1 mg/m ³	10 mg/m ³	None	Eye and skin irritation; cough, chest pain; dyspnea, bronchitis, pneumonitis, tremor; insomnia; irritability, indecision; headache; fatigue, weakness; stomatitis; salivation.	NA	NA	NA
Nickel	311 mg/kg	PEL = 1 mg/m ³	10 mg/m ³		Sensitization dermatitis, allergic asthma, pneumitis.	NA	NA	NA
Silver	2.3 mg/kg	PEL: 0.01 mg/m ³	10 mg/m ³	None	blue-gray eyes, nasal septum, throat, skin irritation	NA	NA	NA
Vanadium	66.8 mg/kg	Ceiling = 0.05 mg/m ³	35 mg/m ³ (as V)	0.5 – 2.2 mg/m ³ (vanadium pentoxide)	Eye, skin and throat irritation, green tongue, metal taste, eczema; cough: fine rales, wheezing, bronchitis.	NA	NA	NA
Zinc	1260 mg/kg	PEL=1 mg/m ³ (ZnOxide) 5 mg/m ³ (ZnChloride)	500 mg/m ³	None	Metal fume fever: chills, muscle ache, nausea, fever, dry throat, cough; lassitude, metallic taste; headache; blurred vision; low back pain; vomiting; malaise	NA	NA	NA
Cyanide	0.45 mg/kg	PEL = 10 ppm ST 2 ppm C 4.7 ppm	50 ppm	0.00027 – 5 ppm	Breathing difficulties, heart pains, vomiting, blood changes, headaches, enlargement of the thyroid gland	13.6	5.6	40
PCBs								
Aroclor 1242	5,000,000 ug/kg	1 mg/m ³ (skin)	Ca (5mg/m ³)	hydrocarbon odor	Irritated eyes, chloracne, liver damage	NE	NE	NE
Aroclor 1260	1,900,000 ug/kg	REL 0.001 mg/m ³	Ca (5mg/m ³)	NA	NA	NE	NE	NE
Aroclor 1254	2,300,000 ug/kg	0.5 mg/m ³ (skin) REL 0.001 mg/m ³	Ca (5mg/m ³)	pale-yellow liquid with mild hydrocarbon odor	Irritated eyes, chloracne, liver damage	NE	NE	NE

Table 1. W.G. Krummrich Plant Site-Specific Potential Chemical Hazards (Continued)

Contaminant	Highest Observed Soil Concentration	PEL/TLV (TWA unless noted)	IDLH	Warning Concentration	Symptoms/Effects of Acute Exposure	Photo Ionization Potential	L.E.L. %	U.E.L. %
Pesticides								
Aldrin	230 ug/kg	PEL: 0.25 mg/m ³ (skin)	Ca (25 mg/m ³)	mild chemical odor	dizziness, vomiting, nausea, myoclonic jerks of limbs, convulsions, coma	NE	NE	NE
4,4'-DDD	46.0 ug/kg	NE – similar to DDT	NE – similar to DDT	NE – similar to DDT	nausea, vomiting, diarrhea, dermatitis, apathy, leukopenia, thrombocytopenia and lassitude. Irritation of the skin and lethargy.	NE	NA	NA
4,4'-DDE	430 ug/kg	TWA = 0.5 mg/m ³ PEL = 1.0 ppm (skin)	500 mg/m ³ Ca	2.9 mg/m ³ - weak chemical odor fruit-like, aromatic (0.35 ppm in water)	Eye and skin irritation; tongue, lip and face parasthesia; tremor apprehension; dizziness; confusion; malaise; headache; fatigue; convulsions; incomplete loss of muscular power in hands; vomiting.	NE	NA	NA
Alpha BHC	26 ug/kg	PEL = 0.5 mg/m ³	50 mg/m ³	Slightly musty odor 3.9 – 21.3 mg/m ³	Eye, nose and respiratory system irritation; headache, nausea, chronic convulsions; respiratory difficulty; cyanosis; aplastic anemia; skin irritation; muscle spasm.	NE	NA	NA
Delta BHC (Lindane)	120 ug/kg	0.5 mg/m ³	50 mg/m ³	3.9 mg/m ³	Irritation eyes, skin, nose, throat; headache; nausea; clonic convulsions; respiratory difficulty; cyanosis; aplastic anemia; muscle spasm;	NE	NA	NA
Alpha-Chlordane	150 ug/kg	PEL=0.5 mg/m ³	Ca 100 mg/m ³	NE	Headaches, irritability, confusion, weakness, vision problems, vomiting, stomach cramps, diarrhea, and jaundice	NE	NA	NA
Gamma-Chlordane	350 ug/kg	Same as alpha-Chlordane	Ca	NE	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions	NE	NA	NA
Dieldrin	600 ug/kg	TWA = 0.25 mg/m ³ (skin) PEL = 0.25 mg/m ³ (skin)	50 mg/m ³	0.41 ppm odorless - mild chemical odor	Headache; dizziness; nausea; vomiting; malaise; sweating; myoclonic limb jerks; clonic; tonic convulsions; coma.	NE	NA	NA
Endosulfan (total)	505 ug/kg	PEL: none REL: 0.1 mg/m ³ (skin)	N.D.	slight sulfur dioxide odor	irritated skin, nausea, confusion, agitation, flushing, dry mouth, tremor, convulsions	NE	NE	NE
Endrin	430 ug/kg	PEL=0.1 mg/m ³ (skin)	200 mg/m ³	NA	Violent convulsions, weakness, nausea. Twitching, tingling of the limbs, temporary deafness, mental confusion and unconsciousness. Dizziness, abdominal discomfort, headache, lethargy, anorexia and death.	NE	NA	NA
Heptachlor	59 ug/kg	TWA = 0.05 mg/m ³ (skin)	35 mg/m ³	0.02 ppm odor like camphor	In animals: Tremors, convulsions, liver damage.	NE	NA	NA

NA = Not available
GW = Groundwater

NE = None established
A = Air

U = Unknown
T = Tailings

S = Soil
CA = Carcinogen

SW = Surface Water

TABLE 3

	Health and Safety Program PROJECT HAZARD ANALYSIS FORM	Attachment PHA-1 Revision: October 2002

Completed by: A. Pinnell Date: 11/18/2002
 Project Name: W.G. Krummrich Project #: 21561197

See SMS #

Determine the applicability of these SMSs to your project

Emergency Action Plan	003
Sanitation	030
Regulatory Inspections	001
Incident reporting	049

Will project activities involve any of the following?	Yes	See SMS #
Abrasive blasting or exposure to abrasive blasting media or waste?		006
Accident investigation?		049
Aerial lifts?		007
Air contaminants in hazardous concentrations?	X	043, 042
Asbestos surveys or abatement oversight?		008
Biological hazards	X	047
Bloodborne Pathogens		051
Boating		027, 053
California job activities?		005
Cold Stress potential to employees working: <ul style="list-style-type: none"> Outdoors in damp and cool (below 50° F or 10°C) conditions anytime temperatures are below 32°F or 0°C. 	X	059
Computer use / ergonomic concerns?		054
Corrosive materials used or handled?	X	009
Confined space entries?		010
Cranes or hoists?		038, 041
Demolition activities of any type of structures?		011
Drilling	X	056, 034
Electrical equipment? <ul style="list-style-type: none"> Generators? Live electrical circuits? 	X	012
Excavations or exposure to excavation hazards?		013
Fall Hazards		040
Flammable or combustible materials used or stored which could constitute a fire hazard?		014, 015
Hand Safety	X	064



Health and Safety Program **PROJECT HAZARD ANALYSIS FORM**

Attachment PHA-1

Revision: October 2002

Will project activities involve any of the following?	Yes	See SMS #
Hand tool use: <ul style="list-style-type: none"> • Portable • Gas powered • Electric • Powder actuated 	X	016
Hazardous materials shipping	X	048
Hazardous substances – physical, chemical or health hazards?	X	002
Hazardous waste activities (investigative or remedial)?	X	017
Heat Stress potential to employees working in: <ul style="list-style-type: none"> • Hot environments; or • Impermeable Chemical Protective Clothing? 		018
Heavy equipment in use at this project site?	X	019
Hot Work (welding, cutting, grinding)		020
Housekeeping	X	021
Industrial site access of any kind?		004
Ireland work activities?		061
Lead exposures (lead paint removal, lead in dust, etc)?		022
Lockout/tagout to control exposure to hazardous energy?		023
Manbasket (Crane Suspended Personnel Platforms) for working at heights?		037, 038, 041
Marine Safety and Boat Operations		053
Medical Surveillance requirements? Examples would include exposures to: <ul style="list-style-type: none"> • Noise • Asbestos • Lead • Hazardous Wastes • High Altitude • Carcinogens • Respirator Use 	X	024
Noise exposures?	X	026
Nuclear Density Gauge Use		044
Outdoor environments	X	047
Portable ladder use?		028
Personal protective equipment?	X	029
Radiation		052
Railroad Systems; railroad train		063
Respiratory protection use – required and/or voluntary?		042
Scaffolding?		031
Sewer Entry		010
Subcontractors?	X	046



Health and Safety Program
PROJECT HAZARD ANALYSIS FORM

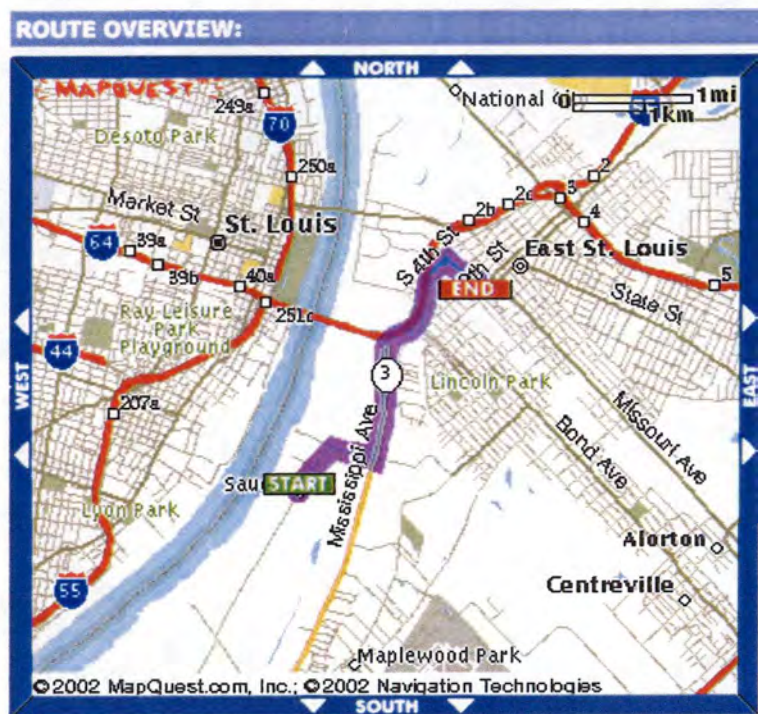
Attachment PHA-1

Revision: October 2002

Will project activities involve any of the following?	Yes	See SMS #
Traffic control due to work in streets and/or roadways?		032
Travel to remote locations and/or developing countries?		036
United Kingdom work activities?		060
Utility Clearances – overhead or underground?	X	034
Unexploded Ordnance/Chemical Warfare agents present or potential?		039
Underground Storage Tank investigation, removal, etc.		033
Water, work over or around?		027
Work at altitudes greater than 7,000 feet (~ 2,100 meters)		035
Working at heights of greater than 6 feet without protective measures such as guard rails?		040

Figures

FIGURE 1
SITE LOCATION MAP



FROM: TO:


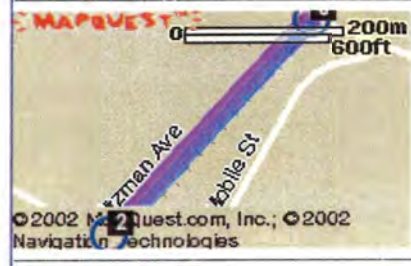

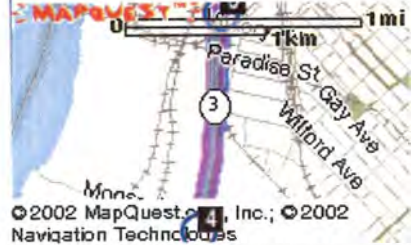
Sauget, IL
JS




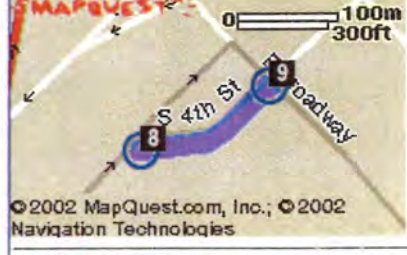


St Mary's Hospital
129 N 8th St # 240
East St Louis, IL
62201-2999 US

Distance: 3.09 miles

Total Estimated Time: 6 minutes

PRINT ROUTE	SAVE ROUTE	E-MAIL ROUTE
REVERSE DIRECTIONS	DOWNLOAD ROUTE TO PDA	
FASTEST ROUTE	SHORTEST ROUTE	AVOID HIGHWAYS

MAP	DIRECTIONS	DISTANCE
	1: Start out going Northeast toward PITZMAN AVE.	0.25 miles
	2: Stay straight to go onto PITZMAN AVE.	0.24 miles
	3: Turn RIGHT onto MONSANTO AVE.	0.37 miles
	4: Turn LEFT onto IL-3/MISSISSIPPI AVE. Continue to follow IL-3 N.	0.94 miles

	5: Take the I-70 E/I-64 E/I-55 N ramp toward IL-3 N/CHICAGO/INDIANAPOLIS.	0.57 miles
	6: Take the FOURTH ST ramp toward BUSINESS DISTRICT/EAST ST LOUIS.	0.22 miles
	7: Turn SLIGHT RIGHT onto S 4TH ST.	0.09 miles
	8: Turn SLIGHT RIGHT onto S 4TH ST.	0.10 miles
	9: Turn RIGHT onto E BROADWAY/I-15.	0.27 miles
	10: Turn LEFT onto N 8TH ST.	0.05 miles

Total Estimated Time:
6 minutes

Total Distance: 3.09 miles

FIGURE 2
ROUTE TO HOSPITAL MAP

APPENDIX A

Safety Forms

URS
SAFETY BRIEFING AND COMPLIANCE AGREEMENT

Date/Time: _____ Project Name: _____
Site Location: _____ Project No.: _____
Site Safety Officer: _____ Project Manager: _____
Activity: _____ Subsite Name: _____

In compliance with the Health and Safety Plan/SHERP, a safety briefing was held for personnel assigned to the field work on the above project and activity. The following topics were covered during the safety briefing:

- _____ Project description and scheduled field activities
- _____ Personnel assignments and responsibilities
- _____ Chemical hazards, identification, and precautions
- _____ Physical hazards, identification, and precautions
- _____ Biological hazards, identification, and precautions
- _____ Hazard assessment by task
- _____ Standard operating procedures, site procedures/prohibitions
- _____ Levels of protection and PPE
- _____ Air monitoring requirements
- _____ Decontamination requirements and procedures
- _____ Work zones and communication systems
- _____ Emergency response procedures

I have received a copy of the Health and Safety Plan/SHERP and attended a safety briefing. I agree to abide by its provisions and to aid the Site Safety Officer in its implementation. I understand it is in the best interest of myself and my co-workers to ensure that site operations are conducted in the safest manner possible. I affirm that my safety training and medical are current and in compliance with OSHA regulations.

Name	Signature	Company

URS
SAFETY MEETING FORM

Date/Time: _____ Project Name: _____

Site Location: _____ Project No.: _____

Site Safety Officer: _____ Project Manager: _____

Activity: _____ Subsite Name: _____

In compliance with the Health and Safety Plan/SHERP, a safety meeting was held and the following topic(s) was/were covered:

Name	Signature	Company

URS
HEALTH AND SAFETY PLAN
COMPLIANCE AGREEMENT

Project Name: _____

Project Number: _____

Description of Activity: _____

Subsite Description: _____

I, _____, have read the Health and Safety Plan and hereby agree to abide by its provisions and to aid the Site Safety Officer in its implementation. I understand that it is in the best interest of myself and my co-workers to ensure that site operations are conducted in the safest manner possible. Therefore, I will be alert to site health and safety conditions at all times.

Signature

Date

APPENDIX B

URS Safety Management Standards (SMSs)

URS SAFETY MANAGEMENT STANDARD

Worker Right-to-Know (Hazard Communication)

1. Applicability

This procedure applies to URS office and field operations.

2. Purpose and Scope

The worker right-to-know program provides URS personnel with information and training about safety and health hazards associated with the chemicals they might encounter in the workplace. This procedure describes how chemical safety hazards are communicated to URS personnel working in offices and at field site locations, and how information is to be provided to employees of other employers working at the location. The requirements include steps to acquire this information, maintain it, and train everyone to use it.

3. Implementation

Office Locations: Implementation of this program is the responsibility of the Office Manager.

Field Activities: Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Hazardous Material Inventory

1. Maintain a hazardous material inventory that lists all of the hazardous materials used at this workplace. Use chemical names consistent with the applicable MSDS's.
2. File a copy of the chemical inventory in the Safety Filing System.

B. Material Safety Data Sheets (MSDS's)

1. Obtain a MSDS for each chemical before it is used.
2. Review each MSDS when it is received to evaluate whether the information is complete and to determine if existing protective measures are adequate.
3. Maintain a collection of all MSDS's where they are accessible at all times.

URS SAFETY MANAGEMENT STANDARD
Worker Right-to-Know (Hazard Communication)

4. Replace MSDS sheets when updated sheets are received.
Communicate any significant changes to those who work with the chemical.
5. MSDS's are required for all hazardous materials used on site by project personnel.

C. Labels

Label all chemical containers with:

1. Identity of the hazardous chemical(s),
2. Appropriate hazard warnings, and
3. Name and address of the chemical manufacturer, importer, or other responsible party.

D. Hazardous Nonroutine Tasks

Periodically, employees are required to perform hazardous non-routine tasks. Prior to starting work on such projects, provide each employee with information about hazards to which they may be exposed during such an activity.

This information will include:

1. Specific chemical hazards.
2. Protective/safety measures which must be utilized.
3. Measures that have been taken to lessen the hazards including ventilation, respirators, presence of another employee and emergency procedures.

E. Informing Contractors/Subcontractors

Provide contractors/subcontractors the following information on chemicals used by or provided to URS personnel:

1. Names of hazardous chemicals to which they may be exposed while on the jobsite.
2. Precautions the employees may take to lessen the possibility of exposure by usage of appropriate protective measures.

URS SAFETY MANAGEMENT STANDARD
Worker Right-to-Know (Hazard Communication)

3. Location of URS MSDS's and written chemical inventory.

F. Training

1. Conduct training of all employees potentially exposed to hazardous materials on the following schedule:
 - a. Before new employees begin their jobs.
 - b. Whenever new chemicals are introduced into the workplace,
or
 - c. Annually thereafter.
2. This training will include:
 - a. Applicable regulatory requirements.
 - b. Names of those responsible for implementing this program.
 - c. Location of the program, inventory and MSDS 's.
 - d. Chemicals used, and their hazards (chemical, physical and health).
 - e. How to detect the presence or release of chemicals.
 - f. Safe work practices.
 - g. How to read an MSDS.
3. Document the training.

5. Documentation Summary

- A. File these records in the Office Safety Filing System
 1. Chemical Inventory.
 2. Location of the MSDS inventory.
 3. Training records.
 4. Contractor/Subcontractor notifications.
- B. File these records in the Project Safety File.

URS SAFETY MANAGEMENT STANDARD
Worker Right-to-Know (Hazard Communication)

1. Chemical Inventory.
2. Location of the MSDS inventory.
3. Training records.
4. Contractor/Subcontractor notifications.

6. Resources

- A. U.S. OSHA Technical Links - Hazard Communication
(<http://www.osha-slc.gov/SLTC/hazardcommunications/index.html>)
- B. U.K. - Control of Substance Hazardous to Health - Regulations

URS SAFETY MANAGEMENT STANDARD

Accessing Industrial Sites

1. Applicability

This procedure applies to projects where URS personnel access industrial sites.

2. Purpose and Scope

The purpose of this procedure is to require that personnel determine the appropriate personal protective equipment, and receive hazard, safety and emergency information when accessing industrial sites.

3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

A. Prior to accessing the site contact the facility to determine:

1. PPE requirements for personnel – SMS 29.
2. The procedure for safely accessing the site.
3. The need for training and/or orientation upon arrival including MSDS.
4. Any other safety procedures specifically required at the site that would require advance planning or coordination.
5. Security requirements.

B. Upon accessing the site:

1. Report to the designated entry location.
2. Attend required safety orientation/briefings.
3. Prepare to comply with site rules.
4. Inquire as to the following issues if not addressed:
 - a. Facility emergency procedures including alarms and evacuation procedures.
 - b. How to activate emergency procedures if necessary.

URS SAFETY MANAGEMENT STANDARD
Accessing Industrial Sites

- c. Information regarding potential chemical exposures:
 - 1. MSDS access - SMS 2.
 - 2. Where these potential exposures exist.
 - 3. Controls in place to prevent exposures.
 - 4. How to identify when exposures may occur.
- d. Safety hazards which may not be inherently obvious and site rules or procedures regarding those hazards.
- e. Traffic issues within the facility including:
 - 1. Lift truck and material handling vehicles.
 - 2. Establishment of Right of Way.
 - 3. Vehicle access to site.
 - 4. Special pedestrian rules.
- f. Major program coordination issues, such as:
 - 1. Confined Space Entry Procedures – SMS 10.
 - 2. Lockout/Tagout and Control of Hazardous Energy Procedures – SMS 23.
 - 3. Utility clearances - SMS 34.

C. Document site issues on Attachment 4-1.

D. Enter the site prepared to comply with URS and site procedures. In the event that there is a discrepancy, coordinate with site representative and prepare to use the most protective procedure.

E. Wherever significant safety issues remain that cannot be resolved locally, contact URS Health and Safety Program Representative for support in resolving such issues.

5. Documentation Summary

Field Operations

URS SAFETY MANAGEMENT STANDARD
Accessing Industrial Sites

- A. File Attachment 4-1 "Accessing Industrial Sites" in the Project Health and Safety File.

6. Resources

- A. U.S. OSHA Standard - Emergency Action Plans - 29 CFR 1910.38
- B. U.S. OSHA Fact Sheet - Responding to Workplace Emergencies
- C. Attachment 4-1 - Assessment Form



Health and Safety Program
HEALTH AND SAFETY ASSESSMENT

Attachment 4-1

Industrial Site _____

Project Manager _____

Date _____

	Yes	No	N/A
PRE JOB SURVEY			
Are there PPE requirements for site access?			
If yes, describe the requirements.			
What are the procedures for safely accessing the site?			
Is there a requirement for orientation or a safety briefing upon arrival?			
Are there any other safety procedures specific to this site that require advance planning?			
If yes, describe the requirements			
UPON ACCESING THE SITE			
Have facility emergency procedures been discussed?			
• Alarms			
• Evacuation Routes			
• Procedures to activate emergency system			
Has the worker Right to Know program for the site been addressed (Hazcom/WHMIS)?			
• Site chemical hazards shared with URS staff?			
• Information provided to owner regarding chemicals brought to site by URS?			
• Are all parties aware of how to detect exposures to chemicals?			
• Have control measures regarding potential chemical exposures been discussed between parties?			
Are there any safety hazards on the site which are not inherently obvious?			



Health and Safety Program
HEALTH AND SAFETY ASSESSMENT

Attachment 4-1

	Yes	No	N/A
If yes, describe hazards and site protective measures.			
Are there any special traffic rules for the site?			
• Lift truck or material handling vehicles onsite?			
• Right of way issues?			
If yes, describe.			
Are there any special rules for contractor vehicles on site?			
• Are there any special pedestrian rules?			
If yes, describe			
Are there any major program coordination issues at this site?			
• Confined Space Entry			
• Lockout/Tagout			
• Process safety line brake issues			
If yes, describe.			
Have all of the above-related issues been shared with all project-related personnel and subcontractors?			
If no, why not?			

Project Manager _____ Date _____

Site Manager _____ Date _____

URS SAFETY MANAGEMENT STANDARD Electrical Safety

1. Applicability

This program applies to URS field operations in North American where electricity is used, electrical systems are installed or maintained, or where live electrical circuits are accessed. For work around overhead or underground utilities, see SMS 34, "Utility Clearances".

2. Purpose and Scope

This procedure describes requirements for working on electrical circuits with voltage greater than 50 volts. The primary hazards related to electricity are shock; burns; arc-blast; fire and explosions. This procedure is intended to reduce worker risk to electrical hazards.

3. Implementation

Office Locations - Implementation of this program is the responsibility of the Office Manager.

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Any work performed on live electrical systems must be done by a licensed or journeyman electrician.

B. Follow established lockout/tagout procedures. Refer to SMS 23, "Lockout and Tagout Safety".

1. Consider all electrical systems as hot until verified de-energized and grounded.

2. Do not work on or in close proximity to electrical circuits unless the circuit is de-energized, grounded or guarded.

C. Hazardous Locations

Determine if electric equipment and wiring will be installed in locations that are classified depending on:

1. The properties of flammable vapors, liquids or gases, or combustible dusts or fibers that may be present; as well as the likelihood that a flammable or combustible concentration or quantity

URS SAFETY MANAGEMENT STANDARD Electrical Safety

is present. (Refer to Attachment 12-1 for definitions of Hazardous Locations)

2. Consult Resources A, B, E, and F for information on working in classified locations.

D. Ground Fault Circuit Interrupters and Grounding

1. Ground Fault Circuit Interruptors

- a. Provide approved ground-fault circuit interrupters for all 120-volt, single phase, 15- and 20-ampere receptacle outlets on construction sites.
- b. Provide ground-fault circuit interrupters for all 120-volt, single phase, 15-and 20-ampere receptacle outlets within garages, bathrooms, kitchens and shops.

2. Grounding/Earthing

Effectively ground all wiring, electrical circuits, and equipment, except portable tools & appliances protected by an UL-approved system of double insulation. Examples of equipment requiring grounding include:

- a. Portable and vehicle or trailer mounted generators.
- b. Electrically powered arc welders.
- c. Switches.
- d. Motor controller cases.
- e. Fuse boxes.
- f. Distribution cabinets.
- g. Frames.
- h. Non-current-carrying rails used for travel and motors of electrically operated cranes.
- i. Electric elevators.

URS SAFETY MANAGEMENT STANDARD Electrical Safety

- j. Metal frames of non-electric elevators to which electric conductors are attached.

E. Circuits

- 1. Require that there are no missing blanks.
- 2. Close doors to circuit and fuse boxes when not in use.
- 3. Label every circuit located on a circuit breaker/fuse box and/or motor control center (MCC).

F. Temporary Wiring, Electrical Tools and Extension Cords

- 1. Require that temporary wiring is installed and used in accordance with references. Specifically:
 - a. Guard, bury or isolate by elevation temporary wiring to prevent accidental contact by workers and equipment.
 - b. Require that vertical clearance above walkways is not less than 10 feet (3 metres) from circuits carrying 600 volts or less.
 - c. Support all exposed temporary wiring on insulators.
 - d. Protect temporary wiring from accidental damage.
 - e. Guard live parts of wiring.
 - f. Mark temporary power lines, switch boxes, receptacle boxes, metal cabinets and enclosures around equipment to indicate the maximum operating voltage.
- 2. Require that lighting strings are installed and used in accordance with Resources A and B. Specifically:
 - a. Use nonconductive lamp sockets and connections permanently molded to the conductor insulation.
 - b. Require that lighting strings have lamp guards.
 - c. Replace all broken or defective bulbs promptly.

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- d. Protect all lights used for illumination from accidental contact or breakage.
 - e. Ground metal-case sockets.
- 3. Require that extension cords are installed and used in accordance with Resources A and B. Specifically:
 - a. Use only 3-wire grounded type extension cords, designated for hard service or extra hard service and listed by Underwriters Laboratories, Inc.
 - b. Check cords for damage before use.
 - c. Do not exceed the rated load.
 - d. Do not use spliced cords.
 - e. Destroy and discard worn or frayed cords.
 - f. Do not fasten extension cords with staples, hang them by nails or suspend them by wire.
 - g. Do not wrap cords or cables around any conductive materials.
- 4. Require that portable electric tools brought onto the site are in good condition. Before use on any shift, visually inspect portable cord and plug connected equipment for external defects and evidence of possible internal damage.
- G. Report to supervision potential electrical hazards or unexpected occurrences while electrical renovation or construction occurs.
- H. Keep accurate records of all pertinent work performed on a project.
 - 1. Keep as-built designs updated.
 - 2. Share information on modifications with contractors on site.
- I. Isolation of live electrical components

Isolate all live, unprotected electrical components through the use of barricades, fencing or other means to protect employees from contact.

URS SAFETY MANAGEMENT STANDARD Electrical Safety

J. Briefing

1. Brief workers on electrical hazards at the beginning of the job.
Utilize Attachment 12-2 as a guide for proper PPE as applicable.
2. Brief new workers entering the site.
3. Brief workers when electrical conditions change or when hazards exist.

K. Inspection

Inspect the job site periodically using Attachment 12-3 to evaluate compliance with this standard.

5. Documentation Summary

Project Safety Files

- A. Licensed/journeyman electrician for project (as necessary).
- B. Attachment 12-3, "Audits."
- C. Documented communications between URS, contractors, licensed/journeyman electricians, or others.

6. Resources

- A. U.S. OSHA Standard - General Industry Electrical Safety - 29 CFR 1910, Subpart S
- B. U.S. OSHA Standard - Construction Electrical Safety - 29 CFR 1926, Subpart K
- C. U.S. OSHA Standard - Design Safety Standards for Electrical Systems - 29 CFR 1910, Subpart S
- D. U.S. OSHA Standard - The Control of Hazardous Energy (Lockout/Tagout) - 29 CFR 1910.147
- E. Australian Standards SAA HB94-1997 - Electrical Safety in the Workplace
- F. American National Standards Institute. ANSI C-2. 1996 National Electrical Safety Code

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- G. National Fire Protection Association, National Electric Code, NFPA-70

The following documents are PDF files requiring the use of Adobe Acrobat reader.

- H. Attachment 12-1 - Hazardous Locations
I. Attachment 12-2 - PPE, Tools and Equipment
J. Attachment 12-3 - Electrical Hazard Check Sheet

URS SAFETY MANAGEMENT STANDARD

Fire Prevention

1. Applicability

This procedure applies URS office and project locations.

2. Purpose and Scope

The purpose of this procedure is to reduce/eliminate potential fire hazards in the workplace and to provide for a rapid, effective response should a fire occur.

3. Implementation

Office Locations – Implementation of this procedure is the responsibility of the Office Manager.

Field Activities – Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

General

- A. Develop an Emergency Action Plan as outlined in SMS 3, "Emergency Action Plans."
- B. Maintain good housekeeping to reduce fire hazards and to provide safe routes of egress should a fire occur.
- C. Provide the appropriate number and types of fire extinguishers for the operations being performed. Refer to Attachment 14-1 for guidance.
- D. Inspect fire extinguishers monthly and maintain an inspection log.
- E. Conduct frequent periodic inspections to identify fire hazards such as:
 - 1. Unnecessary accumulation of combustibles.
 - 2. Unnecessary storage of flammables.
 - 3. Sources of ignition (e.g., faulty wiring, sparks, open flame, etc.).
- F. Remove all fire hazards promptly.
- G. Prohibit smoking and other ignition sources in flammable storage and other fire hazard areas.

URS SAFETY MANAGEMENT STANDARD

Fire Prevention

- H. Post emergency numbers near telephones and evacuation maps in appropriate locations.
- I. Conduct evacuation drills.
- J. Train employees in:
 - 1. Fire hazard recognition.
 - 2. Fire hazard prevention.
 - 3. Fire extinguisher use.
 - 4. Emergency and evacuation procedures.

6. Documentation Summary

File the following in the Office/Project Health and Safety File:

- A. Emergency Action Plans.
- B. Fire extinguisher inspection logs.
- C. Employee training documentation.
- D. Site audits.
- E. Evacuation drills.

7. Resources

- A. U.S. OSHA Standard - Means of Egress - 29 CFR 1910, Subpart E
- B. U.S. OSHA Standard - Employee Emergency Plans and Fire Prevention Plans - 29 CFR 1910.38
- C. U.S. OSHA Standard - Fire Protection - 29 CFR 1910, Subpart L
- D. U.S. OSHA Technical Links - Fire Safety
- E. U.S. OSHA Construction Standard - Fire Protection and Prevention 29 CFR 1926, Subpart F
- F. U.K. - "Fire Precaution" Regulations

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- G. Australian Standards AS 1851.1-1995 - Maintenance of Fire Protection Equipment - Portable Fire Extinguishers and Blankets
- H. Australian Standards Collection 15 - Fire Extinguishing Equipment
- I. USACE EM 385-1-1 Section 9 - Fire Prevention and Protection
- J. Attachment 14-1 - Fire Extinguisher Placement Guidelines

URS SAFETY MANAGEMENT STANDARD

Hand Tools and Portable Equipment

1. Applicability

This procedure applies to URS operations involving the use of hand tools and/or power equipment, including chain saws, brush cutters, powder-actuated tools, and similar high-hazard implements.

2. Purpose and Scope

The purpose of this standard is to provide guidelines for the safe use and handling of hand tools and power equipment.

3. Implementation

Office/Facility Locations - Implementation of this program is the responsibility of the Office Manager.

Field Locations - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. General

1. Keep hand and power tools in good repair and used only for the task for which they were designed.
2. Remove damaged or defective tools from service.
3. Keep surfaces and handles clean and free of excess oil to prevent slipping.
4. Do not carry sharp tools in pockets.
5. Clean tools and return to the toolbox or storage area upon completion of a job.
6. Wrenches must have a good bite before pressure is applied.
 - a. Brace yourself by placing your body in the proper position so that in case the tool slips you will not fall.
 - b. Make sure hands and fingers have sufficient clearance in the event the tool slips.

URS SAFETY MANAGEMENT STANDARD **Hand Tools and Portable Equipment**

- c. Always pull on a wrench, never push.
- 7. When working with tools overhead, place tools in a holding receptacle or secure when not in use.
- 8. Do not throw tools from place to place, from person to person, or drop from heights.
- 9. Use non-sparking tools in atmospheres with fire or explosive characteristics.
- 10. Inspect all tools prior to start-up or use to identify any defects.
- 11. Powered hand tools should not be capable of being locked in the on position.
- 12. Require that all power fastening devices be equipped with a safety interlock capable of activation only when in contact with the work surface.
- 13. Do not allow loose clothing, long hair, loose jewelry, rings and chains to be worn while working with power tools.
- 14. Do not use cheater pipes.
- 15. Make provisions to prevent machines from automatically restarting upon restoration of power.

B. Grinding Tools

- 1. Inspect work rests and tongue guards for grinders.
 - a. Work rest gaps should not exceed 1/8 inch (3 mm).
 - b. Tongue guards gap should not exceed 1/4 inch (6 mm).
- 2. Do not adjust work or tool rests while the grinding wheel is moving.
- 3. Inspect the grinding wheel for cracks, chips or defects. Remove from service if any defects are found.
- 4. Wear goggles when grinding. A clear full face shield may be worn with the goggles.

URS SAFETY MANAGEMENT STANDARD **Hand Tools and Portable Equipment**

5. Do not use the side of a grinding wheel unless the wheel is designed for side grinding.
6. Always stand to the side of the blade, never directly behind it.
7. Use grinding wheels only at their rated speed.
8. Grinding aluminum is prohibited.
9. For U.K. operations:
 - a. No grinding wheels exceeding 55mm are to be used.
 - b. All wheels are to be marked with their safe maximum speed.
 - c. Abrasive wheels will only be operated by personnel who have been specifically trained and specified competent by URS.
 - d. Abrasive wheels will only be operated by persons specified as competent, under the 'Abrasive Wheels' Regulations.
 - e. Abrasive wheels must only be operated if the manufacturer's guard is fitted and they are in good working order.

C. Power Saws

1. Require that circular saws are fitted with blade guards.
2. Remove damaged, bent or cracked saw blades from service immediately.
3. Require that table saws are fitted with blade guards and a splitter to prevent the work from squeezing the blade and kicking back on the operator.
4. Require guards that cover the blade to the depth of the teeth on hand held circular saws. The guard should freely return to the fully closed position when withdrawn from the work surface.

URS SAFETY MANAGEMENT STANDARD **Hand Tools and Portable Equipment**

D. Wood Working Machinery

1. Do not use compressed air to remove dust, chips and from wood working machinery.
2. Locate the on-off switch to prevent accidental start up. The operator must be able to shut off the machine without leaving the work station.
3. Guard planers and joiners to prevent contact with the blades.
4. Use a push stick when:
 - a. The cutting operation requires the hands of the operator to come close to the blade.
 - b. Small pieces are being machined.
5. Adjust saw blades so they only clear the top of the cut.
6. Automatic feed devices should be used whenever feasible.

E. Pneumatic Tools and Equipment

1. Require that pneumatic tools have:
 - a. Tool retainers to prevent the tool from being ejected from the barrel during use.
 - b. Safety clip or tie wire to secure connections between tool/hose/compressor if they are of the quick connection (Chicago fittings) type.
2. Do not lay hose in walkways, on ladder or in any manner that presents a tripping hazard.
3. Never use compressed air to blow dirt from hands, face or clothing.
4. Compressed air exhausted through a chip guarded nozzle shall be reduced to less than 30 psi. Proper respiratory, hand, eye and ear protection must be worn.
5. Never raise or lower a tool by the air hose.

URS SAFETY MANAGEMENT STANDARD **Hand Tools and Portable Equipment**

F. Powder Actuated Fastener Tools

1. Use powder actuated tools that comply with the requirements of the American National Standards Institute (ANSI) standard A 10.3 - 1970.
2. Use only individuals that have been trained by a manufacturer's representative and possess the proper license to operate, repair, service and handle powder actuated tools.
3. Never use a powder actuated tool in a flammable or explosive atmosphere.
4. Require the use of goggles or a full face shield as well as safety glasses during operation of powder actuated tools.
5. Powder actuated tool must not be able to be fired unless the tool is pressed against the work surface.
6. The tool must not be able to fire if the tool is dropped when loaded.
7. Firing the tool should require two separate operations, with the firing movement being separate from the motion of bringing the tool to the firing position.
8. Never fire into soft substrate where there is potential for the fastener to penetrate and pass through, creating a flying projectile hazard.
9. Do not use powder actuated tools in reinforced concrete if there is the possibility of striking the re-bar.
10. Do not use on cast iron, glazed tile, surface hardened steel, glass block, live rock or face brick.
11. Never load and leave a powder actuated tool unattended. It should only be loaded prior to intended firing.
12. Test tools each day prior to loading by testing safety devices according to manufacturer's recommended procedure.

G. Chain Saws

URS SAFETY MANAGEMENT STANDARD Hand Tools and Portable Equipment

1. Inspect the saw prior to each use and periodically during daily use.
2. Operate the chain saw with both hands at all times.
3. Never cut above chest height.
4. Require that the idle is correctly adjusted on the chain saw. The chain should not move when the saw is in the idle mode.
5. Start cutting only after a clear escape path has been made.
6. Shut the saw off when carrying through brush or on slippery surfaces. The saw may be carried no more than 50 feet (15 meters) while idling.
7. Require applicable protective gear. This may include, but is not limited to:
 - a. Loggers safety hat.
 - b. Safety glasses.
 - c. Steel-toed boots.
 - d. Protective leggings.
 - e. Hearing protection.
8. Inspect saws to require that they are fitted with an inertia break and hand guard.
9. Never operate a chain saw when fatigued.
10. Do not allow others in the area when chain saws are operated.
11. Make sure there are no nails, wire or other imbedded material that can cause flying particles.
12. Do not operate a chain saw that is damaged, improperly adjusted, or is not completely and securely assembled. Always keep the teeth sharp and the chain tight. Worn chains should immediately be replaced.

URS SAFETY MANAGEMENT STANDARD **Hand Tools and Portable Equipment**

13. Keep all parts of your body away from the saw chain when engine is running.
14. For U.K. operations, only personnel specifically trained and certified as competent by URS can operate chain saws.

H. Hand Operated Pressure Equipment

1. Pressure equipment such as grease guns, paint and garden sprayers shall be directed away from the body and other personnel in the area. The person operating any equipment such as this, which has a potential for eye injury, must wear protective goggles.
2. The noise produced when using certain types of pressure equipment may require the use of hearing protection.
3. Never allow the nozzle of a pressurized tool to come in contact with any body parts while operating. There is potential for injection of a chemical directly into the user's body, resulting in severe injury or death.

I. Gasoline Powered Tools

1. Never pour gasoline on hot surfaces.
2. Never fuel around open flame or while smoking.
3. Shut down the engine before fueling.
4. Provide adequate ventilation when using in enclosed spaces.
5. Use only OSHA approved safety cans to transport flammable liquids.

J. Inspection

Inspect all hand tools on a regular basis. Defective tools shall be immediately removed from service, tagged or destroyed to prevent further use.

5. Documentation Summary

Place in the Project Safety File:

URS SAFETY MANAGEMENT STANDARD **Hand Tools and Portable Equipment**

- A. Site briefings regarding tool use.
- B. Records of tools removed from service.
- C. Copies of powder actuated tool licenses (as applicable).
- D. Tool inspection documentation.

6. Resources

- A. U.S. OSHA Standard - Hand and Portable Power Tools -
29 CFR 1910, Subpart P
- B. U.S. OSHA Standard - Construction Tools - Hand and Power -
29 CFR 1926, Subpart I
- C. ANSI A10.3 – 1970
- D. National Association of Demolition Contractors
(<http://www.demolitionassociation.com/>)
- E. U.K. - 'Abrasive Wheel' Regulations
- F. U.K. - 'Wood-Working Machine' Regulations
- G. U.K. - 'Provision and Use of Work Equipment' Regulations
- H. Australian Standards Collection 26 - Occupational Health & Safety -
Powered Machining and Tools

URS SAFETY MANAGEMENT STANDARD **Hazardous Waste Operations**

1. Applicability

This standard applies to URS field operations involving the investigation or remediation of sites impacted with hazardous wastes or hazardous materials including those associated with underground storage tanks.

Investigation projects for real estate transactions conducted to confirm that a site is "clean" are not covered under this standard. Reference related Safety Management Standards for such operations.

2. Purpose and Scope

The purpose of this standard is to provide guidance designed to minimize hazardous chemical exposures to URS personnel while URS is conducting hazardous waste field operations.

Investigation techniques included under this standard include, but are not limited to, hand auger, soil gas evaluation, test pits, and all types of power drilling, including direct push. Remediation techniques included under this standard include, but are not limited to, excavation, groundwater treatment, soil gas treatment, containment, and landfarming and similar insitu methods.

3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager or Superintendent.

4. Requirements

A. Project Evaluation

Assess the technical and field aspects of every hazardous waste site project to evaluate:

1. Risk of exposure to hazardous chemicals, with particular attention to suspected or known human carcinogens.
2. Personal protective equipment requirements.
3. Air monitoring requirements.
4. Emergency services requirements.
5. Hazards addressed by other URS Safety Management Standards.

URS SAFETY MANAGEMENT STANDARD Hazardous Waste Operations

6. Logistical considerations, such as access, distance from population centers.
7. Other safety and health hazards associated with site operations.

B. Client/Contract Evaluation

1. Review contract documents to determine whether the client has any special internal or regulatory requirements for hazardous waste site operations.
2. Implement client requirements in addition to those of this standard. Those requirements that are the most protective (e.g., most stringent) will be used.

C. Site-specific Health and Safety Plan

1. Prepare a site-specific Health and Safety Plan (HSP) for every project under this standard.
2. HSPs must be written or reviewed by a URS Health and Safety Regional Health and Safety Manager (RHSM) or a safety professional specifically approved by the RHSM.
3. Evaluate client and agency requirements prior to preparing the HSP, particularly if the client or an agency will approve the HSP prior to implementation.

D. Training

Verify that each assigned URS employee has completed required training. In general, the following are required for operations within North America:

1. 40-hours of initial training from an approved training provider.
2. 3-days of on-the-job training.
3. 8-hours of refresher training completed within 12 months of the initial or subsequent refresher training.
4. 8-hours of Site Safety Officer (Supervisor) training for directing the activities of any other URS employee.
5. Additional training for the Site Safety Officer as described below.

URS SAFETY MANAGEMENT STANDARD Hazardous Waste Operations

E. Site Safety Officer

1. Appoint a Site Safety Officer (SSO) with appropriate qualifications for the specific hazardous waste project.
2. Assure that the SSO for complex projects, such as those with complicated remediation activities, has no duties other than site safety and health.
3. Verify that the SSO has completed basic supervisor training, and has additional required training and experience as applicable:
 - a. Advanced respiratory protection training is required for projects where supplied air respirators may be used.
 - b. Heavy equipment/construction safety.
 - c. Personal air monitoring.

F. Exposure Monitoring

Require that exposure monitoring is conducted in accordance with the HSP on all hazardous waste projects.

G. Project Equipment

1. Provide all health and safety equipment as described by the project Health and Safety Plan.
2. Provide all personal protective equipment as described by the project Health and Safety Plan.

H. Medical Surveillance

Verify that each URS employee assigned to the project meets the minimum requirements of the URS Medical Surveillance Program. This typically includes:

1. Baseline examination.
2. Annual examination.
3. Appropriate clearance for respirator use.

5. Documentation Summary

URS SAFETY MANAGEMENT STANDARD **Hazardous Waste Operations**

In the Project Safety File:

- A. Completed Health and Safety Plan.
- B. Completed and signed HSP approval form.
- C. Signed HSP acceptance form.
- D. Completed H&S field forms that are included in each HSP.
- E. Training and Medical Surveillance Clearance documentation for project personnel.

6. Resources

- A. U.S. OSHA Technical Links - [Hazardous Waste Operations](#)

The following documents are PDF files which must be read with Adobe Reader:

- B. Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities - [NIOSH 85-115](#)
- C. USACE EM 385-1-1 - [Hazardous, Toxic and Radioactive Waste](#)

URS SAFETY MANAGEMENT STANDARD Heavy Equipment Operations

1. Applicability

This procedure applies to URS field projects where heavy equipment is in operation.

2. Purpose and Scope

The purpose of this procedure is to require that heavy equipment is operated in a safe manner, that the equipment is properly maintained and that ground personnel are protected.

3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

A. Authorized Operators

1. Evaluate operators through documentable experience (resume) and a practical evaluation of skills.
2. Allow only qualified operators to operate equipment.
3. Prohibit equipment from being operated by any personnel who have not been specifically authorized to operate it.
4. Maintain a list of operators for the project and the specific equipment that they are authorized to operate.
5. Require operators to use seat belts at all times in all equipment and trucks.
6. Operators shall maintain three points of contact whenever entering and exiting a piece of equipment.
7. Brief operators on the following rules of operation:
 - a. Operators are in control of their work area.
 - b. Equipment will be operated in a safe manner and within the constraints of the manufacturer's Operation Manual.

URS SAFETY MANAGEMENT STANDARD Heavy Equipment Operations

- c. Operators will stop work whenever unauthorized ground personnel or equipment enter their work area and only resume work when the area has been cleared.

B. Ground Personnel

1. Require that ground personnel on the site have received training and comply with the following rules of engagement:
 - a. All ground personnel must wear orange protective vests when in work areas with any operating equipment.
 - b. Ground personnel will stay outside of the swing zone or work area of any operating equipment.
 - c. Ground personnel may only enter the swing or work area of any operating equipment when:
 1. They have attracted the operator's attention and made eye contact.
 2. The operator has idled the equipment down and grounded all extensions.
 3. The operator gives the ground personnel permission to approach.
 - d. Ground personnel shall never walk or position themselves between any fixed object and running equipment or between two running pieces of equipment.

C. Equipment

1. Maintain operations manuals at the site for each piece of equipment that is present on the site and in use.
2. Require that operators are familiar with the manual for the equipment and operate the equipment within the parameters of the manual.
3. Require that all equipment is provided with roll-over protection systems (ROPS). Tracked excavators are exempt from ROPS requirements but must have a cab which provides protection from overhead hazards

URS SAFETY MANAGEMENT STANDARD Heavy Equipment Operations

4. Verify that seatbelts are present and functional in all equipment.
5. Prohibit the use of equipment which has cab glass which is cracked, broken or missing.
6. Require that backup alarms are functional on all trucks and equipment. Tracked excavators must have bidirectional alarms or the operator must be provided with a spotter whenever tracking in either direction.
7. Require all extensions such as buckets, blades, forks, etc. to be grounded when not in use.
8. Require brakes to be set and wheels chocked (when applicable) when not in use.

D. Inspection and Maintenance

1. Require daily inspections of equipment by operators using Attachment 19-1.
2. Prohibit use of equipment deemed to be unsafe as a result of daily inspection until required repairs or maintenance occur.
3. Conduct maintenance as prescribed by the manufacturer in the Operations Manuals for each piece of equipment.
4. During maintenance/repair, require that:
 - a. Motors are turned off.
 - b. All extensions are grounded or securely blocked.
 - c. Controls are in a neutral position.
 - d. Brakes are set.

5. Documentation Summary

File the following documents in the Project Health and Safety File.

- A. List of authorized operators.
- B. Operator qualifications.

URS SAFETY MANAGEMENT STANDARD **Heavy Equipment Operations**

- C. Daily Equipment Inspection Logs.
- D. Site Briefing documentation for operator rules and ground personnel "rules of engagement".

6. Resources

- A. U.S. OSHA Standard - Motorized Vehicles and Mechanized Equipment - 29 CFR 1926, Subpart O
- B. National Association of Demolition Contractors – Safety Manual
- C. Queensland Workplace Health and Safety - Competency Standard for Users & Operators of Industrial Equipment
- D. Attachment 19-1 - Equipment Inspection Form

URS SAFETY MANAGEMENT STANDARD

Housekeeping

1. Applicability

This procedure applies to URS facilities and field operations.

2. Purpose and Scope

Proper housekeeping in office locations, on construction sites, and fixed work facilities is essential to prevent fires as well as injuries resulting from slips, trips and falls.

3. Implementation

Office Locations - Implementation of this program is the responsibility of the Office Manager.

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Maintain the cleanliness of the site.

1. Require tools and equipment to be stowed at the end of the day.
2. Store supplies in locations away from walkways and in a manner that will not trip workers.
3. Keep weeds and vegetation away from stockpiled materials and walkways.
4. Maintain flooring and walkways in a clean, dry, smooth condition.
5. Dispose of construction debris in a timely manner.

B. Regularly inspect the work area for slip and trip hazards.

1. Office locations - inspect work areas at least semi-annually. Utilize the check-sheet provided as Attachment 21-1.
2. Field sites - inspect sites at least monthly. Utilize the check- sheet provided as Attachment 21-1.

C. Thoroughly investigate all injuries resulting from slips, trips and falls on site. Correct conditions contributing to injuries.

URS SAFETY MANAGEMENT STANDARD Housekeeping

5. Documentation Summary

A. Office/Laboratory

File Completed Housekeeping Inspection Sheets (Attachment 21-1), in the Office Safety Filing System.

B. Field

File Completed Housekeeping Inspection Sheets (Attachment 21-1), in the Project Safety File.

6. Resources

- A. U.S. OSHA Standard - Sanitation - 29 CFR 1910.141
- B. U.S. OSHA Standard - Aisles and Passageways - 29 CFR 1910.22.
- C. U.K. - 'The Workplace' (Health & Safety and Welfare) Regulations
- D. U.K. - 'The Construction' (Health and Welfare) Regulations
- E. Attachment 21-1 - Housekeeping Inspection Sheet

URS SAFETY MANAGEMENT STANDARD

Medical Screening & Surveillance

1. Applicability

This program applies to employees assigned to work environments where there is a potential for exposure to chemical, biological, and/or physical hazards. Individuals will be selected for medical screening based on regulatory standards, project health and safety plan assessments, the expected use of personal protective equipment, and client contract requirements.

2. Purpose and Scope

The overall goal of this program is to prevent occupational illness and injury by early identification of exposure-related health effects before they result in disease. Medical examinations will be performed in order to determine if employees are capable of safely performing assigned tasks, to verify protective equipment and controls are effectively providing protection, and to comply with governmental regulations. Included are provisions for emergency medical consultation and treatment.

3. Implementation

Office/laboratory locations – Implementation is the responsibility of the Office Manager.

Field activities – Implementation is the responsibility of the Project Manager.

Program Administration – The Occupational Health Specialist (OHS) is responsible for development and administration of this program in coordination with the URS Medical Service Provider (MSP). The OHS will maintain current injury and illness data and participate with Corporate Health & Safety Managers in evaluation of this program. The MSP will provide board certified occupational medicine oversight for the program and will approve medical surveillance protocols.

The United States and Canada locations will follow all requirements of this program.

International locations will follow sections B.1,2,3,5,6,7,8; G.3; and H.1 of this program.

4. Requirements

A. Selection of program participants.

URS SAFETY MANAGEMENT STANDARD Medical Screening & Surveillance

1. The Medical Surveillance Evaluation (MSE) form provides the primary guidance for determining whether medical screening is required for an employee and the frequency of periodic exams. The MSE is to be completed by the employee and their supervisor at time of hire for any employee who may work outside an office environment and is to be reviewed for accuracy at each annual performance review. Other reviews are required whenever there is a change in job tasks.
2. Additional site/project specific biological monitoring or toxicological screening may be required in addition to this program's core exam schedule. These medical tests will be specified by the project-specific health and safety plan and will be authorized by the MSP on the exam appointment protocol. Note: See section D.2 if employee will have an initial assignment at a HAZWOPER site.

B. Types of medical screening and surveillance exams

1. A baseline or preassignment baseline exam will be conducted prior to the start of work assignments requiring medical surveillance.
2. Periodic exam schedules are established by the MSP using the following criteria:
 - a. Employees performing the following types of work will receive annual exams: construction activities in the exclusion zone of HAZWOPER sites, field work activities in the exclusion zone of HAZWOPER sites for 30 or more days per year, projects involving exposure to OSHA-regulated materials at or above established action levels.
 - b. Employees performing the following types of work will receive biennial exams: field work activities at HAZWOPER sites less than 30 days per year; waste disposal activities; non-HAZWOPER environmental sampling; chemistry laboratory, pilot plant projects, or bench scale operations for 30 or more days per year.
3. Employees currently participating in an examination program will receive exit exams when they leave their work assignment as identified in the Exit Exam Determination. In the event an employee declines the exit exam, the employee will be requested to sign a Waiver of Exit Medical Surveillance Exam.

URS SAFETY MANAGEMENT STANDARD Medical Screening & Surveillance

4. Department of Transportation (DOT) exams will be conducted biennially when an employee is assigned to drive a vehicle with a gross weight rating of more than 10,000 pounds or when driving a placarded vehicle of any size used to transport hazardous chemicals. DOT exam certification can be added to a routine baseline or periodic exam protocol when scheduling with the MSP.
5. When noise levels in the employee's work environment equal or exceed an 8-hour time-weighted average of 85 decibels as measured on the A-scale (dBA), annual audiograms will be performed. For employees involved in construction activities or management of construction, enrollment in this program will be required if more than 50% of their time is spent in an active construction area.
6. Individual radiation dose monitoring will be conducted as required by the site-specific health and safety plan with approval by a Radiation Safety Officer. Personal dosimetry (film badges) are typically required, however, depending on the specific radiation hazard, additional excretory monitoring or thyroid scans may be required.
7. In order to determine an employee's ability to wear a respirator, a medical evaluation will be performed before an employee is fit tested or assigned to wear a respirator.
8. Employees assigned to work environments with airborne concentrations of asbestos fibers at or above the established action level will receive asbestos-specific baseline and annual exams. Exit exams will be performed if an exam has not been performed within the past 6 month period or if an employee has medical complaints related to asbestos exposure.

C. Exam protocols

1. The Medical Screening & Surveillance Exam Protocol identifies the medical exam components of this program.

D. Scheduling of exams

1. The Office or Project Manager, usually with assistance of the local H&S Representative, is responsible for contacting the MSP when baseline, exit, and project specific exams are required. The MSP maintains an employee scheduling database for tracking periodic

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exams and will contact the employee for scheduling the month their exam is due. These steps are detailed in the Medical Surveillance Exam Process.

2. Construction Services Division employees hired with an initial assignment to work at a OSHA HAZWOPER site whose work duties require passing a physical exam or who have an essential job function of wearing a respirator, will receive a job offer contingent upon passing a preassignment baseline exam. See HAZWOPER & Respirator Preassignment Baseline Exam Process. In the event of an urgent business necessity a temporary clearance to begin work the day of the exam, issued by the local physician and good for 14 days until the MSP physician final clearance is received, may be requested at the time a baseline exam is scheduled through the MSP.
3. If an exam becomes due during an employee's pregnancy, it is advised to defer the exam until after delivery and the employee returns to work from family/medical leave status.

E. Exam Follow Up

1. Following each exam, the MSP will issue a physician's written opinion (Health Status Medical Report) to the site Health & Safety Representative which will include any medical restrictions and address the employee's ability to use personal protective equipment. See Exam Follow Up Procedures.
2. The MSP will mail the exam invoice to the site H&SR who will approve the charge and forward the invoice to the accounts payable department for payment.
3. The MSP will mail an exam results letter that is confidentially addressed to the employee at their home address within 30 days of the exam date.

F. Emergency Medical Care

1. Preplanning is essential to a prompt and proper response to a medical emergency. Site specific emergency procedures will be provided in the site Health & Safety Plan. See Field First Aid Kit Supply List for recommended supplies. The contents of the first aid kit shall be checked prior to being sent out to each site/project and periodically thereafter to ensure the expended items are replaced.

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2. A MSP occupational physician can be reached 24 hours a day for phone consultation at WorkCare™ 1-800-455-6155.
3. A workers' compensation claim should be filed by the Human Resource Representative with AIG Claim Services (1-877-366-8423) for an injured employee who receives professional medical care or who is disabled from working beyond the initial date of injury.
4. In order to comply with OSHA reporting regulations, immediately notify the OHS or a Division Health & Safety Manager if there is a work-related hospitalization or death.

G. Medical Records

1. Medical records are maintained and preserved in confidential, locked files in the custody of the MSP for at least the duration of employment plus 30 years. Only information regarding the employee's ability to perform the job assignment will be provided to company representatives.
2. Upon request, each employee (or designated representative) will have access to the employee's medical record. Prior to the release of health information to the employee (or designated representative), a specific written consent must be signed by the employee.
3. International records (excluding the United States and Canada) will be maintained in country at the local clinic.

H. Program evaluation

1. The OHS and Division Health & Safety Managers will evaluate this program annually and as needed. Issues to review include program efficacy and efficiency, employee satisfaction, and cost effectiveness.
2. The MSP will prepare an Annual Medical Trending Report specifying the number and types of exams performed and anonymous statistical exam results in group data format.
3. Each employee is mailed a Post-Exam Evaluation by the MSP. Employee feedback regarding the clinic, medical staff, and exam

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procedures are reviewed and corrective actions are identified and acted upon as needed.

5. Documentation Summary

The H&SR will file the Medical Surveillance Evaluation and the Health Status Medical Report in the site health & safety records.

6. Resources

- A. U.S. OSHA Technical Links - Medical Screening/Surveillance
- B. U.S. OSHA Publication 3162 (1999) Screening and Surveillance: A Guide to OSHA Standards
- C. Attachment 24-1 WorkCare Medical History Questionnaire
- D. Attachment 24-2 Medical Surveillance Evaluation
- E. Attachment 24-3 Medical Screening & Surveillance Exam Protocol
- F. Attachment 24-4 Medical Surveillance Exam Process
- G. Attachment 24-5 HAZWOPER/Respirator Preassignment Baseline Exam Process
- H. Attachment 24-6 Exit Exam Determination
- I. Attachment 24-7 Waiver of Exit Medical Surveillance Exam
- J. Attachment 24-8 Exam Follow Up Procedures
- K. Attachment 24-9 Field First Aid Kit Supply List
- L. SMS 8 Asbestos Survey and Oversight Operations
- M. SMS 17 Hazardous Waste Operations
- N. SMS 42 Respiratory Protection

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Noise and Hearing Conservation

1. Applicability

This procedure applies to URS Corporation facilities and field operations where URS Corporation personnel may encounter noise exposures that may exceed 85 dBA as an 8 hour Time Weighted Average.

2. Purpose and Scope

The purpose of this procedure is to protect employees from hazardous noise exposures and to prevent hearing loss.

3. Implementation

Office/Lab locations: High noise is unlikely to be encountered at URS offices, however, if applicable, the implementation of this program is the responsibility of the Office Manager.

Field Activities: Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. General

The use of hearing protectors in any location where powered or motorized equipment or any other noise source could reasonably be expected to exceed 85 dBA. Use of hearing protectors may only be discontinued when noise levels are verified to be less than 85 dBA through a properly conducted noise survey. Whenever information indicates that any employee's exposure may equal or exceed an 8-hour time-weighted average of 85 decibels, the project manager or location manager will be responsible to enforce the proper use of hearing protectors.

B. Hearing Protectors

1. Require that at least two (2) types of hearing protectors are available to employees free of charge, preferably a plug and a muff type.
2. Minimum Noise Reduction Ratings (NRR)

Hearing protectors issued must have the following minimum NRR:

Ear Plug	Muffs
29 dBA	27 dBA

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3. Require that hearing protectors are used and thus effectively protect hearing.

C. Noise Surveys

1. Noise surveys must be conducted in a manner that reasonably reflects the exposure of the affected employees. Surveys must be conducted under the supervision of a URS Safety Program Representative.
2. Sound level meters and audio dosimeters used to determine employee exposure to noise sources must be Type II (accurate to within +/- 2 dBA), operated in "slow" response, on the "A" scale, and be calibrated to factory guidelines (including periodic factory recalibration).

D. Noise Controls

Eliminate noise sources to the extent possible. Examples of controls that must be considered follow:

1. Addition or replacement of mufflers on motorized equipment.
2. Addition of mufflers to air exhausts on pneumatic equipment.
3. Following equipment maintenance procedures to lubricate dry bearings.
4. Isolation of loud equipment with newer and quieter models.

E. Audiometric Exams

1. Tests

Details on the medical surveillance program (including audiometric testing) are included in SMS 24.

Audiometric tests shall be performed by a person meeting OSHA's 1910.95 (g)(3)'s definition. Within 6 months of an employee's first exposure at or above the action level, a valid baseline audiogram shall be established against which subsequent audiograms can be compared. Testing to establish a baseline audiogram shall be preceded by 14 hours without exposure to noise. Hearing protectors may be used as a substitute for the requirement that

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baseline audiogram shall be preceded by 14 hours without exposure to workplace noise. The medical surveillance provider shall notify employees of the need to avoid high levels of non-occupational noise exposure during the 14-hour period immediately preceding the audiometric examination. For multi-year projects, an annual audiogram shall be obtained for each employee exposed at or above an 8-hour time-weighted average of 85 decibels.

Each employee's annual audiogram shall be compared to that employee's baseline audiogram to determine if the audiogram is valid and if there is a standard threshold shift (STS). If the annual audiogram shows that an employee has suffered a standard threshold shift, the employer will obtain a retest within 30 days and consider the results in assessing an STS as the annual audiogram. The audiologist, otolaryngologist, or physician shall review problem audiograms and shall determine whether there is a need for further evaluation. If an STS has occurred, the medical surveillance provider will notify the employee within 21 days of the determination.

2. Standard Threshold Shifts

If an employee's test results show a confirmed STS, their hearing protection will be evaluated and refitted, and a medical evaluation may be required.

F. Training

Verify that each employee who must work in a noisy environment is current on the required Hearing Conservation Training. Training must include the following topics:

1. The effects of noise on hearing.
2. The purpose of hearing protectors.
3. The advantages and disadvantages of various types of hearing protectors.
4. The attenuation of various types of hearing protection.
5. The selection, fitting, care, and use of hearing protectors.
6. The purpose of audiometric testing.

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7. An explanation of the audiometric testing procedure.

5. Documentation Summary

- A. File these records in the Office Safety Filing System:
 1. Noise surveys, when applicable.
 2. Training Records.
- B. File noise surveys, when applicable, in the Project Safety File:

6. Resources

- A. U.S. OSHA Standard – Occupational noise exposure – 29 CFR 1910.95
- B. U.S. OSHA Construction Standard – Occupational noise exposure – 29 CFR 1926.52
- C. U.S. OSHA Technical Links - Noise and Hearing Conservation
- D. American Industrial Hygiene Association: The Occupational Environment – Its Evaluation and Control, Chapter 20. Fairfax, VA: 1997
- E. National Hearing Conservation Association web site
- F. URS SMS 24 Medical Screening and Surveillance

URS Safety Management Standard **Personal Protective Equipment**

1. Applicability

This program applies to URS Corporation laboratory and field operations where the use of Personal Protective equipment (PPE) is warranted. Refer to SMS 42, "Respiratory Protection", for respiratory hazards. Hearing Protection issues are additionally addressed in SMS 26, "Noise and Hearing Conservation."

2. Purpose and Scope

This procedure provides information on recognizing those conditions that require personal protective equipment as well as selecting personal protective equipment for hazardous activities.

3. Implementation

Shop/Lab Locations - Implementation of this program is the responsibility of the Office Manager.

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

- A. Perform hazard assessments for those work activities that are likely to require the use of PPE.
 - 1. Use Attachment 29-1 to perform the assessment.
 - 2. Reevaluate completed hazard assessments when the job changes.
- B. Eliminate the hazards identified in Attachment 29-1, if possible, through engineering or administrative controls.
- C. Select PPE that will protect employees if hazards cannot be eliminated.
 - 1. See Attachment 29-1 for recommended PPE.
 - 2. Review Material Safety Data Sheets for chemicals used for PPE recommendations.
 - 3. If needed, consult with the URS Health and Safety Representative for assistance in selecting PPE.

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- D. Provide required PPE to employees free of charge (excluding in some instances components of standard work attire such as steel-toed boots), assuring that it fits properly giving them a choice if more than one type is available.
- E. Whenever a hazard is recognized, and PPE is required, the employees will be provided with the appropriate PPE. However, when a PPE is not required, and the employee selects to wear his or her own PPE, the project manager shall ensure that the employee is properly trained in the fitting, donning, doffing, cleaning, and maintenance of his or her employee owned equipment.
- F. Conduct and document employee training.
 - 1. Train all employees who are required to wear PPE.
 - 2. Require that training includes:
 - a. When PPE is necessary to be worn.
 - b. What PPE is necessary.
 - c. How to properly don, doff, adjust and wear PPE.
 - d. Limitations of PPE
 - e. Proper care, maintenance, useful life and disposal of PPE.
 - 3. Training must be conducted before PPE is assigned.
 - 4. Refresher training is needed when:
 - a. New types of PPE are assigned to the worker.
 - b. Worker cannot demonstrate competency in PPE use.
 - 5. Keep written records of the employees trained and type of training provided, including the date of training.
- G. Maintain Protective Equipment
 - 1. Check personal protective equipment for damage, cracks, and wear prior to each use. Replace or repair equipment not found in good condition.

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2. Wash off contaminated protective equipment with water and mild soap, if necessary, to prevent degradation of the equipment.
- H. Periodically inspect worksites where employees are using personal protective equipment, using Attachment 29-2.
 1. Field activities – inspect work sites at least monthly.
 2. Office locations – inspect work sites semi-annually.

5.0 Documentation Summary

- A. Records required in the Project Safety File:
 1. Completed Hazard Assessment Certification Forms (Attachment 29-1)
 2. Completed Personal Protective Equipment Inspection Sheet (Attachment 29-2)
 3. Documentation of employee training.
- B. Records required in the Laboratory Safety Filing System:
 1. Completed Hazard Assessment Certification Forms (Attachment 29-1)
 2. Completed Personal Protective Equipment Inspection Sheet (Attachment 29-2)
 3. Documentation of employee training.

6.0 Resources

- A. U.S. OSHA Standards - Personal Protective Equipment -29CFR 1910 Subpart I
(<http://www.osha-slc.gov/SLTC/lead/index.html>)
- B. U.S. OSHA Construction Standard - Personal Protective Equipment –29 CFR 1926 Subpart E
(http://www.osha-slc.gov/OshStd_toc/OSHA_Std_toc_1926_SUBPART_E.html)
- C. U.S. OSHA Technical Links - Personal Protective Equipment
(<http://www.osha-slc.gov/SLTC/personalprotectiveequipment/index.html>)

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- D. Australian Standards SAA HB9-1994 - Occupational Personal Protection
- E. American National Standards Institute, ANSI Z89.1-1986, Protective Headwear
(http://www.ansi.org/cat_top.html)
- F. American National Standards Institute, ANSI Z87.1 - 1989, Eye and Face Protection
(http://www.ansi.org/cat_top.html)
- G. American National Standards Institute, ANSI Z41.1 - 1991, Foot Protection
(http://www.ansi.org/cat_top.html)
- H. SMS 40 - Fall Protection
- I. Attachment 29-1 Hazard Assessment Form
- J. Attachment 29-2 PPE Inspection Form

URS SAFETY MANAGEMENT STANDARD

Utility Clearances And Isolation

1. Applicability

This procedure applies to URS projects where personnel may encounter subsurface or overhead utilities.

2. Purpose and Scope

Many field activities are conducted near aboveground and underground utilities. The primary purpose of this Standard is to establish operating requirements that will permit employees to work safely in the vicinity of electrical, natural gas, fuel, water, and other utility systems and installations. The secondary purpose is to prevent economic damage to utility systems from operations associated with project-related activities.

The term "utility clearance" includes

- A. The positive locating of utility systems in or near the work area.
- B. A signed statement by an appropriate representative attesting to the location of underground utilities and/or the positive de-energizing (including lockout) and testing of electrical utilities.

Note that in some cases, utility representatives may deem it appropriate or necessary to use insulating blankets to isolate a power line; this is an acceptable alternative to positive de-energizing (only utility representatives can make the determination).

"Contact" with overhead power lines is considered to occur when equipment is closer to power lines than permitted by the criteria in the table in Section 4.0.C.2.b below. (See note for U.K. operations).

3. Implementation

Field Operations - Implementation of this procedure is the responsibility of the Project Manager.

4. Requirements

A. Time for Completion

Complete utility clearances prior to the start of any work in the area of the utility that could feasibly result in contact with or damage to that utility.

B. Local Regulations

URS SAFETY MANAGEMENT STANDARD **Utility Clearances And Isolation**

Research local codes and regulations regarding utility locating and isolation requirements. Utility companies and locating services are among the appropriate resources.

C. Overhead Power Lines

1. Proximity to Power Lines

No work is to be conducted within 50 feet (15 meters) of overhead power lines without first contacting the utility company to determine the voltage of the system. No aspect of any piece of equipment is to be operated within 50 feet (15 meters) of overhead power lines without first making this determination.

2. Operations adjacent to overhead power lines are **PROHIBITED** unless one of the following conditions is satisfied:

- a. Power has been shut off, positive means (such as lockout) have been taken to prevent the lines from being energized, lines have been tested to confirm the outage, and the utility company has provided a signed certification of the outage.
- b. The minimum clearance from energized overhead lines is as shown in the table below, or the equipment will be repositioned and blocked so that no part, including cables, can come within the minimum clearances shown in the table.

MINIMUM DISTANCES FROM POWERLINES	
Powerlines Nominal System kV	Minimum Required Distance
0-50	10 feet (3 meters)
51-100	12 feet (3.6 meters)
101-200	15 feet (4.6 meters)
201-300	20 feet (6.1 meters)
301-500	25 feet (7.6 meters)
501-750	35 feet (10.7 meters)
751-1000	45 feet (13.7 meters)

Note: for U.K. operations, the specific safe distance is determined by the utility company.

- c. The power line(s) has been isolated through the use of insulating blankets which have been properly placed by the utility. If insulating blankets are used, the utility will determine

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Utility Clearances And Isolation

the minimum safe operating distance; get this determination in writing with the utility representative's signature.

3. All inquiries regarding electric utilities must be made in writing and a written confirmation of the outage/isolation must be received by the Project Manager prior to the start of work.

D. Underground Utilities

1. Do not begin subsurface work (e.g., trenching, excavation, drilling, etc.) until a check for underground utilities and similar obstructions has been conducted. The use of as-built drawings must be confirmed with additional geophysical or other survey.
2. Contact utility companies or the state/regional utility protection service at least two (2) working days prior to excavation activities to advise of the proposed work, and ask them to establish the location of the utility underground installations prior to the start of actual excavation.
3. Obtain utility clearances for subsurface work on both public and private property. Clearances are to be in writing, signed by the party conducting the clearance.
4. Protect and preserve the markings of approximate locations of facilities until the markings are no longer required for safe and proper excavations. If the markings of utility locations are destroyed or removed before excavation commences or is completed, the Project Manager must notify the utility company or utility protection service to inform them that the markings have been destroyed.
5. Do not conduct mechanical-assisted subsurface work (e.g., powered drill rig, mechanical excavator, etc.) within five (5) feet (1.5 meters) of a confirmed or suspected utility or other subsurface structure. Confirm minimum distances for mechanical-assisted subsurface work with the utility owner, as distances beyond this five foot minimum may be required.
6. Subsurface work within five feet (1.5 meters) of a confirmed or suspected utility or other subsurface structure must be done by hand (e.g., hand auger, shovel) to the point where the obstruction is visually located and exposed. Once the obstruction location is confirmed in this manner, mechanical-assisted work may commence.

URS SAFETY MANAGEMENT STANDARD **Utility Clearances And Isolation**

7. Reference SMS 13, "Excavation Safety" for additional information regarding subsurface operations.

E. Training

Conduct a site briefing for site employees regarding the hazards associated with working near the utilities and the means by which the operation will maintain a safe working environment. Detail the method used to isolate the utility and the hazards presented by breaching the isolation.

5. Documentation Summary

File these records in the Safety Filing System:

1. Documents requesting utility clearance.
2. Documents confirming utility clearance.
3. Training/briefing documentation of each isolation.

6. Resources

1. Utility Locating Services (typically under "Utility" in the Yellow Pages)
2. NIOSH Alert - Preventing Electrocutions from Contact Between Cranes and Power Lines
(<http://www.cdc.gov/niosh/crane.html>)
3. One Call Utility Locating List
(<http://www.underspace.com/refs/ocdir.htm>)
4. National Utility Locating Contractor's Association
(<http://www.underspace.com/nu/index.htm>)
5. U.K. - Health and Safety Executive GS6

URS SAFETY MANAGEMENT STANDARD Respiratory Protection

1. Applicability

This program defines responsibilities and procedures and is applicable to URS operations that may require the use of respiratory protection including Immediately Dangerous to Life and Health (IDLH) and emergency conditions. This program also addresses the voluntary use of respirators.

2. Purpose and Scope

The purpose of this procedure is to protect those employees performing operations for which exposures can not be controlled by use of conventional engineering or administrative controls and prior to establishing a negative air exposure assessment, and to require that respiratory protective equipment is selected, used, maintained, and stored in accordance with acceptable practices.

3. Implementation

Laboratory/Office/Shop Locations -	Implementation of this program is the responsibility of the Office Manager.
Field Activities -	Implementation of this program is the responsibility of the Project Manager.
Program Administration-	URS Health and Safety Director is responsible for the development and annual review of this program.

URS Health and Safety Program Representatives are responsible to:

- Assist responsible employees in the implementation of the program.
- Assessing local compliance with the program.

4. Requirements

- A. Determine if respirators are needed or going to be used for hazardous jobs before assigning that job to an employee.
 1. If the determination is that a potential for respiratory hazards exists with any portion of that job activity then, complete Attachment 42-1.
 2. Contact a URS Health and Safety Program Representative if any of the questions in Attachment 42-1 are checked "yes."

URS SAFETY MANAGEMENT STANDARD **Respiratory Protection**

3. Follow instructions in Attachment 42-2 for employees who wish to voluntarily use dust masks.
4. Follow all the requirements of this procedure for employees who wish to voluntarily use tight-fitting (e.g., air purifying) respirators.
5. Required respirators will be paid for by URS and will be provided without cost to the employee.

B. Select the proper respirator for the job.

1. For those jobs identified in Attachment 42-1, contact a URS Health and Safety Program Representative for assistance in respirator selection.
2. Contact a URS Health and Safety Program Representative for follow up if there are any problems implementing the recommendations made.

C. Require employees who will use respirators to be medically qualified before fit testing and assigning them a respirator.

1. For program details, refer to SMS 24. Medical Screening and Surveillance.
2. Require that employees have a current and accurate Medical Surveillance form (Attachment 24-2)
3. Obtain a copy of the employee's Health Status Medical Report from the Health and Safety Representative. The consulting occupational physician of the medical service provider following each work related examination issues the Health Status Medical Report. Employees cannot be assigned respirators unless they are medically cleared for respirator use.

D. Require respirator users to receive appropriate training.

1. All respirator users must be trained:
 - a. Before they are assigned a respirator.
 - b. Annually thereafter.
 - c. Whenever a new hazard or job is introduced.

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- d. Whenever employees fail to demonstrate proper use or knowledge.
- 2. Training must address, at a minimum, the following:
 - a. Why the respirator is necessary, and what conditions can make the respirator ineffective.
 - b. What the limitations and capabilities of the respirators are.
 - c. How to use respirators effectively in emergency situations.
 - d. How to inspect, put on and remove, and check the seals of the respirator.
 - e. What the respirator maintenance and storage procedures are.
 - f. How to recognize medical signs and symptoms that may limit or prevent effective use of the respirator.
- E. Require respirator users to be fit tested.
 - 1. Any employee who has been assigned a reusable respirator must be fit tested on an annual basis (no more than one year may elapse between fit tests), or when the employee is assigned a respirator of a different make, type or size from that previously tested.
 - 2. Fit testing can be performed by contract or in house personnel.
 - 3. Obtain a signed written copy of the fit test results. The fit test results should include:
 - a. Employee's name and social security number.
 - b. Respirator brand, model and size fitted for.
 - c. Date fit tested.
 - d. Method of fit testing used.
 - e. Name and signature of fit tester.
 - f. Statement that fit test protocol met the requirements of 29 CFR 1910.134.

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Respiratory Protection

g. Manufacturer and serial number of fit testing apparatus.

A fit test results form is available at Attachment 42-5.

F. Provide qualified employees with respirator(s) and adequate amounts of parts and cartridges.

1. Assign employees whose duties require respirators their own respirator for which they have been fit tested.
2. Provide special eyeglass inserts designed for the respirator if an employee must wear eyeglasses with a full facepiece respirator. Contact lenses may be worn when wearing a full facepiece respirator.

G. Require respirators to be used properly.

1. Prohibit facial hair where the respirator-sealing surface meets the wearer's face.
2. Require employees to perform a positive and negative fit check every time the respirator is put on.
3. Employees will leave the area where respirators are being used:
 - a. Before removing the facepiece for any reason.
 - b. To change cartridges.
 - c. If any of the following is detected:
 1. Vapor or gas breakthrough.
 2. Leakage around the facepiece.
 3. Changes in breathing resistance.
4. Use cartridges with End of Service Life Indicators or determine the respirator cartridge changeout schedule. See Attachment 42-4 for Guidance.

H. Require respirators to be cleaned and stored properly.

1. Clean and disinfect respirators after each use.

URS SAFETY MANAGEMENT STANDARD **Respiratory Protection**

2. Store respirators in a plastic bag or case and in a clean location.
3. Inspect respirators before use and after each cleaning.
- I. Address issues associated with special use respirators self-contained breathing apparatus; air supply respirators; emergency use respirators).

1. Self Contained Breathing Apparatus

Inspect self-contained breathing apparatus and other emergency use respirators monthly and after each use in accordance with manufacturer's instructions.

2. Air Supplied Respirators

- a. Air used for atmosphere-supplying respirators must meet or exceed the requirements for Type 1 - Grade D breathing air. Never use oxygen.

1. A certificate of analysis must accompany bottled air.

2. Compressors used to supply breathing air must:

- i. Prevent entry of contaminated air into the air supply.
 - ii. Minimize moisture content.
 - iii. Have suitable in-line sorbent beds and filter to provide appropriate air quality.
 - iv. Have a high carbon monoxide alarm that sounds at 10 ppm.

- b. Couplings on air hose lines must be incompatible with other gas systems.

- J. Require follow up training and medical surveillance to be provided as directed.

1. Provide follow-up physical examinations as directed by the SMS 24-3, Medical Screening and Surveillance Exam Protocol table.
 2. Provide follow-up physicals as directed by the Regional Medical Surveillance Administrator.

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3. Provide annual refresher training.
4. Provide annual fit testing.

5. Documentation Summary

A. Laboratory

1. File these records in the Laboratory Safety Filing System
 - a. Completed forms:
 1. "Identifying When A Respirator Is Needed" - Attachment 42-1; and,
 2. "Respirator Standard Operating Procedure" - Attachment 42-3.;
 - b. Employee Health Status Medical Report includes clearance for respirator use.
 - c. Employee Fit Test Records; and,
 - d. Employee Respirator Training Records.
2. Send a copy of the following records to the Regional Health and Safety Manager:
 - a. Completed "Voluntary Use of Respirators" form - Attachment 42-2.
 - b. Employee Fit Test Records.
 - c. Employee Respirator Training Records.

B. Field

1. File these records in the Project Health and Safety File:
 - a. Completed forms:
 1. "Identifying When A Respirator Is Needed" - Attachment 42-1; and,

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2. "Respirator Standard Operating Procedure" - Attachment 42-3.
 3. Employee Health Status Medical Report includes clearance for respirator use.;
 4. Employee Fit Test Records; and,
 5. Employee Respirator Training Records.
2. Send a copy of the following records to the Regional Health and Safety Manager:
- a. Completed "Voluntary Use of Respirators" form - Attachment 42-2;.
 - b. Employee Fit Test Records; and,
 - c. Employee Respirator Training Records.

6. Resources

- A. U.S. OSHA Standard - Respiratory Protection - 29 CFR 1910.134
 - B. U.S OSHA Technical Links - Respiratory Protection
 - C. ANSI Z88.6, Respirator Use – Physical Qualifications for Personnel, Current Revision
 - D. ANSI Z88.2, Respiratory Protection, Current Revision
 - E. 3M Cartridge Service Life Interactive Program
 - F. Australian Standards AS/N25 1715 - 1994. Selection, Use, and Maintenance of Respiratory Protection Devices
 - G. Australian Standards HB9-1994. Occupational Personal Protection
 - H. AIHA, The Occupational Environment - Its Evaluation and Control
- The following documents are PDF files which must be read with Adobe Reader;
- I. NIOSH Respirator Decision Logic

URS SAFETY MANAGEMENT STANDARD
Respiratory Protection

- J. NIOSH Guide to Industrial Respiratory Protection
- K. Attachment 42-1 - Identifying When a Respirator is Needed
- L. Attachment 42-2 - Voluntary Use of Respirators
- M. Attachment 42-3 - Respirator Standard Operating Procedure
- N. Attachment 42-4 - Respiratory Cartridge Change Schedule
- O. Attachment 42-5 - Fit Test Results Form
- P. Medical Screening and Surveillance Program - SMS 24

URS SAFETY MANAGEMENT STANDARD

Subcontractor Health and Safety Requirements

1. Applicability

This procedure is applicable to subcontractors retained by URS to perform construction (including drilling and excavation), alteration, demolition, and/or repair activities utilizing their own workforce or equipment. This procedure is applicable to the operations of subcontractors and sub-subcontractors of any tier.

This procedure does not apply to third party contractor operations where there is no subcontract relationship between the contractor and URS Corporation. Health and safety issues regarding third party contractor operations are governed by project specific contracts and are not covered by this standard.

2. Purpose and Scope

This procedure provides guidelines on the pre-evaluation of subcontractor safety programs. It also provides guidance on contractual risk management, subcontractor safety performance on the job site, and the responsibilities of the Project Manager with respect to subcontractor jobsite safety performance.

It is recommended that each URS Corporation subcontractor be evaluated at least annually using Attachment 46-1, "Subcontractor Safety Evaluation Form," in order to perform work on any new URS Corporation projects.

3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager.

4. Guidelines

A. Pre qualification of Subcontractor - The Project Manager shall complete the following procedures for all subcontractors retained on projects covered by this standard (the PM should also require subcontractors to follow these procedures with respect to pre-qualification of sub-subcontractors of any tier):

1. Request all subcontractor candidates to complete the attached "Subcontractor Health and Safety Evaluation Form" (Attachment 46-1).
2. Conduct an assessment of each subcontractor's qualifications with respect to the subcontractor health and safety evaluation criteria contained in Attachment 46-2.

URS SAFETY MANAGEMENT STANDARD **Subcontractor Health and Safety Requirements**

3. Verify that subcontractors meet the insurance requirements as stated in Attachment 46-2 or as approved by Counsel.
4. If the subcontractor has been successfully evaluated within the last 12 months, that evaluation may be substituted.
5. For long term projects, this evaluation should be updated within 12 months of the previous evaluation.

B. Contractual and Risk Management Requirements of Subcontractors

1. Ensure that subcontractor is contractually bound to comply with applicable client and URS Corporation Health and Safety Program requirements.
2. Ensure that subcontractor is contractually bound to develop additional safety procedures for work that is exclusive to their activities on the site and for which they may have superior knowledge.
3. Assess compliance of subcontractor's insurance with the URS Corporation subcontract requirements (including, but not limited to, necessary types and amounts of coverage, URS Corporation additional insured endorsement, etc.).
4. Ensure that URS Corporation has the right in its subcontract, without liability to the subcontractor, to stop the subcontractor's work in the event of any violations of the applicable Health & Safety Plan.

C. Subcontractor Safety Representative

1. Require each subcontractor to appoint a Subcontractor Safety Representative (SSR) who:
 - a. Is knowledgeable of the subcontractor's activities.
 - b. Understands the safety requirements of the subcontractor's activities.
 - c. Has the ability to recognize and the authority to correct safety deficiencies and execute a stop work order should an imminent danger arise.

URS SAFETY MANAGEMENT STANDARD **Subcontractor Health and Safety Requirements**

- d. Has the responsibility for the administration of the subcontractor Health and Safety Program.
- e. Will serve as the direct contact with URS Corporation regarding resolution of Health and Safety issues.

D. Communication

1. Provide the SSR with information regarding Site Safety Program including but not limited to:
 - a. Client Requirements.
 - b. URS Corporation Site Safety Program.
 - c. Site Hazard Communication Program.
 - d. Site Emergency Action Plan.
 - e. Any additional safety information from other contractors or subcontractors working on the site.
2. Provide SSR with name of URS Corporation project contact and alternate for addressing site Health and Safety issues.
3. Require the participation of subcontractors in all Site Safety Briefings.
4. Require subcontractor compliance with all safety directives and/or stop work orders issued by the URS Corporation site representatives.

E. Subcontractor Safety Performance

1. To the extent reasonable in light of URS Corporation's scope of work under the client contract, visit the site and periodically observe subcontractors operations (i.e., conduct spot checks) to assess whether subcontractor appears to be conducting its operations in accordance with applicable health and safety requirements. Periodically review any required subcontractor health and safety written documentation for compliance with applicable requirements.
2. In the event that deficiencies are observed immediately bring them to the attention of the SSR for resolution.

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Subcontractor Health and Safety Requirements

3. In the event of observation of an "Imminent Danger" situation (i.e. involving a situation that could result serious injury or death), immediately contact the SSR and stop the work.
4. Investigate all injuries/illnesses related to subcontractor operations to identify causes and effect corrective actions.
5. In the event of serious and/or continuing subcontractor breaches of applicable health and safety requirements contact legal counsel to assess whether formal contractual action is appropriate under the subcontract.

5. Documentation Summary

A. File in the Project Safety File

1. Subcontractor Health and Safety Evaluation Form.
2. Applicable and current Insurance Certificates.
3. Names and telephone numbers of SSR for each subcontractor.
4. Verification of Health and Safety documents transmitted to subcontractors and received from subcontractors.
5. Identified safety deficiencies as applicable for subcontractors and verification of correction of conditions.
6. All other safety related documentation between URS Corporation and subcontractor such as training certifications, etc.
7. Subcontractor safety plan, incident reports and resolution reports.

6. Resources

- A. Federal OSHA Workplace Injury and Illness statistics
(<http://www.osha.gov/oshstats/work.html>)
- B. Managing Subcontractor Safety, Prepared by The Construction Industry Institute, Safety Task Force, Publication 13-1, The University of Texas at Austin, Austin, Texas, 1991 (<http://www.construction-institute.org/>)
- C. American National Standard Construction and Demolition Operations -- Safety and Health Program Requirements for Multi-Employer Projects,

URS SAFETY MANAGEMENT STANDARD
Subcontractor Health and Safety Requirements

- ANSI A10.33-1992, National Safety Council, Itasca, Illinois 60143-3201
(<http://www.nsc.org>)
- D. "Liability, OSHA and the Safety of Outside Contractors," Professional Safety, American Society of Safety Engineers, January 1993
(<http://www.asse.org>)
- E. "Proactive Construction Management; Dealing With the Problem of Subcontractor Safety," Professional Safety, American Society of Safety Engineers, January 1990 (<http://www.asse.org>)
- F. "Design Professional Liability Under OSHA," Presented by Thomas F. Holt, Jr., HWAC Lawyer's Roundtable, June 14, 1995 (to be Published)
(<http://www.hwac.org>)
- G. "Occupational Injury and Illness Rates by SIC", Bureau of Labor Statistics, U. S. Department of Labor (<http://stats.bls.gov/sahome.html>)
- H. Attachment 46-1 - Subcontractor Safety Evaluation Form
- I. Attachment 46-2 - Subcontractor Evaluation Criteria

URS SAFETY MANAGEMENT STANDARD

Biological Hazards

1. Applicability

This program applies to job activities performed primarily in outdoor environments.

2. Purpose and Scope

The primary goal of this program is to eliminate or reduce illnesses and injuries transmitted by plants, insects, and animals. Although there are many animals and insects that are potentially harmful to humans (i.e. bees, spiders, bears, and rodents), this safety management standard focuses on four common biological hazards: ticks, poison plants, mosquitoes, and snakes.

3. Implementation

The Project Manager, with support from the URS H&S Regional Managers and Occupational Health Specialist, will be responsible for implementation of this program.

4. Requirements

A. Ticks

1. Precautionary Measures

Background information: Ticks do not jump, crawl, or fall onto a person. They are picked up when clothing or hair brushes a leaf or other object the tick is on. Ticks are generally found within three feet of the ground. Once picked up, they will crawl until they find a likely site to feed. Often they will find a spot at the back of the knee, near the hairline, behind the ears, or at pressure points where clothing presses against the skin (underwear elastic, belts, neckline). The best way to prevent tick borne diseases is not to be bitten by a tick. Ticks can carry a number of diseases including:

- Lyme Disease is an infection caused by the corkscrew-shaped bacteria *Borrelia burgdorferi* that is transmitted by the bite of deer tick (ixodes) and western black-legged ticks. The disease occurs in the forested areas of North America, Europe, and Asia. Symptoms which occur 3-30 days following a tick bite include: a spreading "bulls-eye" rash, fever, fatigue, headache, and joint and muscle aches. Prompt treatment with antibiotics is essential in order to prevent more serious complications that may occur if left untreated.

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- Rocky Mountain Spotted Fever is an infection caused by the bacteria *Rickettsia rickettsii*. The disease occurs in North, Central, and South America. Other *Rickettsia* organisms cause disease worldwide (Mediterranean, Japan, Africa, North Asia). Symptoms which occur 2-6 days following a tick bite include: fever, nausea, vomiting, diarrhea, rash, muscle and joint pain. The disease is treated with antibiotics.
- Babesiosis is caused by hemoprotezoan parasites of the genus *Babesia*. It is transmitted by the ixodid tick. The geographic distribution is worldwide. Symptoms include fever, chills, fatigue, muscle aches, and an enlarged spleen and liver. The disease is treated with anti-protozoan drugs.
- Ehrlichiosis is caused by several bacteria of the genus *Ehrlichiae*. The geographic distribution is global, primarily in temperate regions. Symptoms which occur 5-10 days following a tick bite include fever, headache, fatigue, muscle aches, nausea, vomiting, diarrhea, confusion, and occasionally a rash. The disease is treated with antibiotics.

a. Avoidance of tick habitats

Whenever possible, persons should avoid entering areas that are likely to be infested with ticks, particularly in spring and summer when nymphal ticks feed. Ticks favor a moist, shaded environment, especially that provided by leaf litter and low-lying vegetation in wooded, brushy, or overgrown grassy habitat. Both deer and rodent hosts must be abundant to maintain the life cycle of the tick.

b. Personal Protective Equipment

1. Wear light colored clothing or white Tyvek® to allow you to see ticks that are crawling on your clothing.
2. Tuck your pant legs into your socks or boots, wear high rubber boots, or use tape to close the opening where they meet so that ticks cannot crawl up the inside of your pant legs.
3. Wear a hat, tie back long hair.
4. Apply repellents to discourage tick attachment. Repellents containing permethrin can be sprayed on boots and clothing and will last for several days. Repellents containing DEET (n,n-diethyl-

URS SAFETY MANAGEMENT STANDARD **Biological Hazards**

m-toluamide) can be applied to the skin, but will last only a few hours before reapplication is necessary. Apply according to Environmental Protection Agency guidelines to reduce the possibility of toxicity.

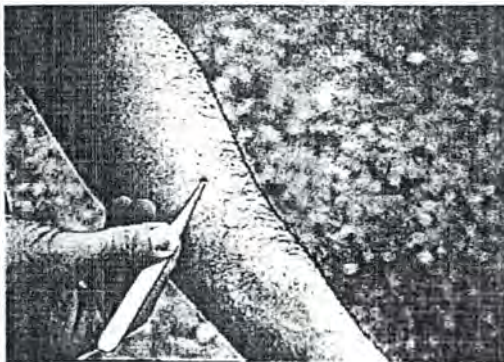
c. Tick Check

1. Change clothes when you return from an area where ticks may be located.
2. Shower to wash off any loose ticks.
3. Check your entire body for ticks. Use a hand held or full-length mirror to view all parts of your body.
4. Place clothing worn in tick infested areas into the dryer for at least 30 minutes in order to kill any ticks.

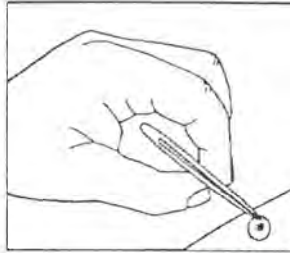
2. Tick Removal

Because it takes several hours of attachment before microorganisms are transmitted from the tick to the host, prompt removal of attached or crawling ticks is an important method of preventing disease. Remember, folklore remedies of tick removal to do not work! Methods such as the use of petroleum jelly or hot matches may actually make matters worse by irritating the tick and stimulating it to release additional saliva or regurgitate gut contents, increasing the chances of transmitting disease.

The best method to remove an attached tick is with a set of fine tipped tweezers.



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- a. Use fine-tipped tweezers. When possible, avoid removing ticks with bare hands.
 - b. Grasp the tick as close to the skin surface as possible and pull upward with steady, even pressure. Do not twist or jerk the tick; this may cause the mouthparts to break off and remain in the skin. If this happens, remove mouthparts with the tweezers.
 - c. Do not squeeze, crush, or puncture the body of the tick because its fluids (saliva and gut contents) may contain infectious organisms.
 - d. After removing the tick, thoroughly disinfect the bite site and wash your hands with soap and water.
 - e. Disinfect the tweezers.
 - f. Save the tick for identification in case you become ill. This may help the doctor make an accurate diagnosis. Place the tick in a vial or plastic zip lock bag and put it in the freezer. Write the date of the bite on a piece of paper with a pencil and place it in the bag.
3. Medical Follow-Up

In most circumstances, medical treatment of persons who only have a tick bite is not recommended. However, individuals who are bitten by a tick

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should seek medical attention if any signs and symptoms of tick borne disease develop over the weeks following the tick bite.

B. Poisonous Plants

1. Background Information

Poison ivy and poison oak plants are the most common cause of allergic contact dermatitis in North America. These poisonous plants can be a hazard for many various outdoor activities at work, home, and play. Skin contact with the oleoresins (urushiol) from these plants can cause an itchy, red, oozing, blistered rash in sensitive individuals. Oil content in the plants is highest in the spring and summer, however the plants are even hazardous in the winter when they have dropped their leaves. There are three types of exposure:

- Direct contact: An initial skin exposure is necessary to "sensitize" the individual. Subsequent contact in a sensitized person will result in a rash appearing within 4 to 48 hours. Approximately 50-70 % of the population is sensitized. Poison plant dermatitis is usually characterized by areas of linear or streaked patches where branches of the plant brushed the skin.
- Indirect contact: Skin exposure can happen indirectly. Clothing, shoes, tools, personal protective equipment and other items can be contaminated with the oils and maintain potency for months.
- Airborne smoke contact: Never burn poison plants. Droplets of oil can be carried by smoke and enter the respiratory system causing a severe internal outbreak.

Poison plant rash is not contagious. Skin contact with blister fluid from an affected individual will not cause dermatitis in another sensitized person. Scratching the rash can only spread it to other parts of your body if the oil is still on your skin. After the oil has been washed off or absorbed by the skin, scratching will not spread the rash.

The most distinctive features of poison ivy and poison oak are their leaves, which are composed of three leaflets each and are green in the summer and red in the fall. Both plants also have greenish-white flowers and berries that grow in clusters. All parts of these plants are toxic.

URS SAFETY MANAGEMENT STANDARD **Biological Hazards**

Poison Ivy grows as a small plant, vine, and as a shrub. Leaves always consist of three glossy leaflets.



Poison Ivy

Poison Oak grows as a shrub or vine. It has three leaflets that resemble oak leaves.



Eastern Poison Oak

Poison Sumac grows as a woody shrub or small tree from 5 to 25 feet tall. It has 7 to 13 leaves that grow opposite each other with a leaflet at the tip.



Poison Sumac

1. Precautionary Measures

- The best approach is to learn to identify the plants and avoid them.
- Wear long pants and long sleeves, boots and gloves.
- Barrier skin creams may offer some protection if applied before contact.

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- Avoid indirect contact from tools, clothing or other objects that have come into contact with a crushed or broken plant. Don't forget to wash contaminated clothing and clean up contaminated equipment.
- If you can wash exposed skin areas within 3-5 minutes with cold running water, you may keep the urushiol from penetrating your skin. Proper washing may not be practical in remote areas, but a small wash-up kit with pre-packaged alcohol-based cleansing tissues can be effective.

2. Medical Follow-Up

Home treatment: Calamine lotion and an oatmeal (one cup to a tub full of water) bath can help relieve itching. To prevent secondary skin infection, scratching is not helpful and the finger nails should be cut to avoid damage to the skin. Over-the-counter hydrocortisone cream can decrease inflammation and itching, however read the label and use according to directions.

When to see the doctor: Severe cases may require further treatment. A physician should be seen if the rash appears infected, is on the face or other sensitive body areas, or is too extensive to be easily treated at home.

C. Mosquito Borne Diseases

1. Background Information

- a. Arboviral encephalitis is a viral illness causing inflammation of the brain and is transmitted to humans by the bite of infected mosquitoes. Globally there are several strains including: Eastern equine, Japanese, La Crosse, St. Louis, West Nile, and Western equine encephalitis. Some of the strains have a vaccine. Symptoms of infection are nonspecific and flu-like: fever, headache, and tiredness. Fortunately, only a small proportion of infected people progress to encephalitis. Treatment is supportive, antibiotics are not effective.
- b. Malaria is a serious but preventable disease spread by the bite of an infected anopheline mosquito. It is caused by four species of the parasite *Plasmodium* (*P. falciparum*, *P. vivax*, *P. ovale*, and *P. malariae*). Malaria-risk areas include primarily tropical areas of Central and South America, Africa, India, Southeast Asia, and the Middle East. Symptoms of malaria which occur 8 days to 1 year after infection

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include fever, shaking chills, headache, muscle ache, tiredness, jaundice, nausea, vomiting, and diarrhea. Malaria can be cured with prescription drugs.

- c. Dengue Fever is a potentially life-threatening viral illness transmitted by the bite of the Aedes mosquito, found primarily in urban areas. The disease is found in most of tropical Asia, the Pacific Islands, Central and South America, and Africa. There are four dengue virus serotypes. Symptoms include sudden onset, high fever, severe headache, joint and muscle pain, rash, nausea and vomiting. There is no specific treatment and no vaccine.
- d. Yellow Fever is a viral disease transmitted between humans by mosquitoes. It occurs only in Africa and South America. There is a vaccine that confers immunity lasting 10 years or more. Symptoms begin 3-6 days after the mosquito bite and include fever, nausea, vomiting, headache, slow pulse, muscle aches, and restlessness. Treatment is symptomatic.

2. Precautionary Measures

- Insect Repellent – Use insect repellants that contain DEET. The effect should last about 4 hours. Always use according to label directions. Use only when outdoors and wash skin after coming indoors. Do not breathe in, swallow, or get into the eyes. Do not put on wounds or broken skin.
- Protective Clothing – wear long sleeved shirts and long pants, especially from dusk to dawn. Or avoid going outdoors during these hours.
- Mosquito netting – Travelers who will not be staying in well-screened or air conditioned rooms should use a pyrethroid containing flying insect spray in living and sleeping areas during evening and nighttime hours. Sleep under mosquito netting (bed nets) that have been sprayed with permethrin.
- Malaria prophylaxis medications may be prescribed, however they do not provide complete protection. The type of medication given depends on the area of travel.

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Biological Hazards

D. Poisonous Snakes

1. Background Information

No single characteristic distinguishes a poisonous snake from a harmless one except the presence of poison fangs and glands. Only in dead specimens can you determine the presence of these fangs and glands without danger. Most poisonous snakes have both neurotoxic and hemotoxic venom, however, one type is dominant and the other is weak.

- a. Hemotoxic venom. The folded-fang snakes (fangs can raise to an erect position) have venoms that affect the circulatory system, destroying blood cells, damaging skin tissues, and causing internal hemorrhaging.
- b. Neurotoxic venom. The fixed-fang snakes (permanently erect fangs) have venoms that affect the nervous system, making the victim unable to breathe.
- c. Poisonous snakes in the Americas: copperhead, coral snake, cottonmouth, and rattlesnake.
- d. Poisonous snakes in Europe: adder, viper.
- e. Poisonous snakes of Africa and Asia: viper, cobra, adder, green mamba.
- f. Poisonous snakes in Australia: copperhead, adder, taipan, tiger snake.

2. Precautionary Measures

Bites occur when you don't hear or see the snake, when you step on them, or when you walk too close to them. Follow these simple rules to reduce the chance of accidental snakebite:

- Don't put your hands into dark places, such as rock crevices, heavy brush, or hollow logs, without first investigating.
- Don't step over a fallen tree. Step on the log and look to see if there is a snake resting on the other side.
- Don't walk through heavy brush or tall grass without looking down. Look where you are walking.

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Biological Hazards

- Do not pick up any live snake. If you encounter a snake, walk around the snake, giving it plenty of room. A snake can strike half its length.
- Don't pick up freshly killed snakes without first severing the head. The nervous system may still be active and a dead snake can deliver a bite.

3. Medical Follow-up

If you are bitten by a snake, the primary goal is to get to a hospital as soon as possible to receive professional medical evaluation and possible treatment with antivenom if warranted. Initial first aid should include: Wash the bite with soap and water. Immobilize the bitten area and keep it lower than the heart. Try to remain calm. If you are unable to reach a hospital within 30 minutes, a bandage, wrapped two to four inches above the bite, may help slow the venom. The bandage should not cut off blood flow from a vein or artery, make sure the band is loose enough that a finger can slip under it. A suction device from a commercial snakebite kit may be placed over the bite to help draw venom out of the wound.

Research has shown the following to be potentially harmful, DO NOT: apply ice, use a tourniquet, or make incisions into the wound.

5. Documentation Summary

Complete and distribute a URS Incident Report form 49-1 for all work-related biological exposure incidents.

6. Resources

Centers for Disease Control
<http://www.cdc.gov>

U. S. Occupational Safety and Health Administration
<http://www.osha.gov>

U.S. Food and Drug Administration
Treating and Preventing Venomous Snake Bites

URS SAFETY MANAGEMENT STANDARD

Injury / Illness / Incident Reporting

1. Applicability

This procedure applies to URS Corporation offices and field operations.

2. Purpose and Scope

The purpose of this procedure is to provide guidance for the timely reporting of work related injuries, illness, and incidents.

3. Implementation

Office Locations - Implementation of this program is the responsibility of the employee's Supervisor.

Field Activities - Implementation of this program is the responsibility of the Project Manager.

4. Requirements

A. Reporting: All employees shall immediately notify their appropriate level of management (line, project, and/or office) of a reportable incident. A reportable incident includes the following:

1. An injury to any URS employee, subcontractor, client representative, or private citizen, even if the injury does not require medical attention;
2. An injury to a member of the public occurring on a URS work site or possibly resulting from a URS or subcontractor activity or involving URS or subcontractor property, equipment, or resource;
3. Illness resulting from suspected chemical exposure;
4. Chronic or re-occurring conditions such as back pain or cumulative trauma disorders (example: carpal tunnel syndrome);
5. Fire, explosion, or flash;
6. Any vehicle accidents occurring on site, while traveling to or from client locations, or with any company-owned or leased vehicle;
7. Property damage resulting from any URS or subcontractor activity;
8. Structural collapse or potential structural hazards;

URS SAFETY MANAGEMENT STANDARD **Injury / Illness / Incident Reporting**

9. Unexpected release or imminent release of a hazardous material;
 10. Unexpected chemical exposures to workers or the public;
 11. A safety related complaint from the public regarding URS activities.
 12. Any other significant occurrence that could impact safety.
- B. Actions: The following actions will be taken following a reportable incident:
1. Employees:
 - a. If necessary, suspend operations and secure and/or evacuate the area;
 - b. Immediately notify your supervisor and/or project manager
 - c. Record information pertaining to the incident (e.g., time, date, location, name and company of person(s) involved, description of event, and actions taken);
 - d. Assist with incident investigation as directed by management;
 - e. Implement corrective actions as directed by management;
 - f. *Do not* discuss the incident with members of the news media or legal representatives (except URS legal counsel or your personal legal advisor) unless directed to do so by URS management;
 - g. *Do not* make statements pertaining to guilt, fault, or liability.
 2. Line/Project Management:
 - a. Review circumstances of the incident with applicable employee(s);
 - b. Notify local Health and Safety representative. If incident involves and an injury/illness of a URS employee, also notify the local Human Resources Representative;
 - c. Complete and distribute injury/incident report within 24 hours. (Note: If the employee is unable to complete the

URS SAFETY MANAGEMENT STANDARD

Injury / Illness / Incident Reporting

report, another company employee, line manager, project manager, or local health and safety representative may complete the report.);

- d. Review and verify that necessary corrective actions are identified and implemented;
- e. Discuss with department or project staff the circumstances surrounding the incident and corrective actions taken.

3. Local Health And Safety Representative

- a. Assist with incident evaluation;
- b. With management, identify cause(s) of incident and identify corrective actions needed to avoid recurrence;
- c. Review injury/incident report for completeness and accuracy;

4. Local Human Resources Representative

- a. Report work-related injuries and illness to worker compensation carrier

AIG Claim Services @ 1-877-366-8423

5. Corporate Health and Safety Management

The Occupational Health Specialist (OHS), and Corporate Health and Safety Director will review all reported incidents (U.S.-based employees only) to determine OSHA reporting and recording requirements. All decisions will be based strictly on current Federal OSHA guidelines.

- a. Official records (including required reports, logs, for all reported incidents will be maintained at one central location by the OHS.
- b. The OHS will send each establishment any required government report for their establishment following receipt of an incident report.
- c. Each January the OHS will prepare and distribute, to each URS establishment, the appropriate government

URS SAFETY MANAGEMENT STANDARD **Injury / Illness / Incident Reporting**

injury/illness reports. These reports will summarize all required government information for incidents that occurred during the preceding calendar year. Each establishment will post these reports in a prominent location for the time specified by current regulations.

5. Documentation Summary

A. File these records in the Office Safety File:

1. Attachment 49-1 - Incident Report Form
2. Maintain OSHA 200 Log.

B. File these records in the Project Health and Safety File

1. Attachment 49-1 - Incident Report Form
2. Maintain OSHA 200 Log if applicable for Project.

6. Resources

A. U. S. OSHA

<http://www.osha.gov>

URS SAFETY MANAGEMENT STANDARD

Drilling Safety Guidelines

1. Applicability

This program applies to URS projects in which truck-mounted, or other engine powered, drill rigs are used. It is applicable to URS employees and URS owned rigs. For drill rigs operated by contractors, the primary responsibility for drilling safety is with the drilling contractor.

2. Purpose and Scope

The purpose of these guidelines is to provide an overview for working safely around drilling operations with truck-mounted and other engine-powered drill rigs. The procedure addresses off-road movement of drill rigs, overhead and buried utilities, use of augers, rotary and core drilling, and other drilling operations and activities.

3. Implementation

Field Activities Drill rig safety and maintenance is the responsibility of the drill rig operator. URS employees are responsible for their own safety including recognizing and avoiding drill rig hazards. URS employees that observe a drill rig condition believed to be unsafe shall advise the drill rig operator of the unsafe condition.

4. Safety Guidelines

A. General Guidelines

URS technicians, geologists, engineers, or other field staff assigned to observe drilling operations or collect soil samples should observe the following guidelines:

- Require a meeting at project start-up regarding the drill rig operator responsibility for rig safety and any site and equipment specific safety requirements.
- Set up any sample tables and general work areas for the URS field staff to the side of the drill rig (preferably 10 meters away) and not directly behind the rig.
- URS engineers, technician, and geologists shall not assist the drillers with the drilling equipment or supplies and shall not at any time operate the drill rig controls.

B. Movement of Drill Rigs

Before moving a rig, the operator must do the following:

URS SAFETY MANAGEMENT STANDARD **Drilling Safety Guidelines**

- To the extent practical, walk the planned route of travel and inspect it for depressions, gullies, ruts, and other obstacles.
- Check the brakes of the truck/carrier, especially if the terrain along the route of travel is rough or sloped.
- Discharge all passengers before moving on rough or steep terrain.
- Engage the front axle (on 4x4, 6x6, etc. vehicles) before traversing rough or steep terrain.

Driving drill rigs along the sides of hills or embankments should be avoided; however, if side-hill travel becomes necessary, the operator must conservatively evaluate the ability of the rig to remain upright while on the hill or embankment. The possibility must be considered that the presence of drilling tools on the rig may reduce the ability of the rig to remain upright (raises the center of mass of the rig).

Logs, ditches, road curbs, and other long and horizontal obstacles should be normally approached and driven over squarely, not at an angle.

When close lateral or overhead clearance is encountered, the driver of the rig should be guided by another person on the ground.

Loads on the drill rig and truck must be properly stored while the truck is moving, and the mast must be in the fully lowered position.

After the rig has been positioned to begin drilling, all brakes and/or locks must be set before drilling begins. If the rig is positioned on a steep grade and leveling of the ground is impossible or impractical, the wheel of the transport vehicle should be blocked and other means of preventing the rig from moving or topping over employed.

C. Buried and Overhead Utilities

The location of overhead and buried utility lines must be determined before drilling begins, and the locations should be noted on boring plans and/or assignment sheets.

When overhead power lines are close by, the drill rig mast should not be raised unless the distance between the rig and the nearest power line is at least 20 feet (7 meters) or other distance as required by local ordinances, whichever is greater. The drill rig operator or assistant should walk completely around the rig to make sure that proper distance exists.

When the drill rig is positioned near an overhead line, the rig operator should be aware that hoist lines and power lines can be moved towards each other by wind. When necessary and approved by the Project

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Manager (PM), the utility and/or power lines may be shielded, shut down, or moved by the appropriate personnel.

For additional information, please refer to SMS #34 "Utility Clearances and Isolation".

D. Clearing the Work Area

Before a drill rig is positioned to drill, the area on which the rig is to be positioned should be cleared of removable obstacles and the rig should be leveled if sloped. The cleared/leveled area should be large enough to accommodate the rig and supplies.

E. Safe Use of Augers

Never place hands or fingers under the bottom of an auger flight or drill rods when hoisting the augers or rods over the top of another auger or rod in the ground or other hard surfaces, such as the drill rig platform.

Never allow feet to get under the auger or drill rod while they are being hoisted.

When the drill is rotating, stay clear of the drill string and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.

Move auger cuttings away from the auger with a long-handled shovel or spade; never use hands or feet.

Never clean an auger attached to the drill rig unless the transmission is in neutral or the engine is off, and the auger has stopped rotating.

Do not wear loose clothing or jewelry while working near the drill rig. Long hair must be pulled back to avoid entanglement with moving parts.

Hearing protection is required when working near an operating drill rig.

F. Safe Use of Hand Tools

Regulations regarding hand tools should be observed in addition to the guidelines provided below:

- Each tool should be used only to perform tasks for which it was originally designed.
- Damaged tools should be repaired before use or discarded.
- Safety goggles or glasses should be worn when using a hammer or chisel. Nearby co-workers and by-standers should be required to wear safety goggles or glasses also, or move away.

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- Tools should be kept cleaned and stored in an orderly manner when not in use.

G. Safe use of Wire Line Hoists, Wire Rope, and Hoisting Hardware

Safety rules described in Title 29 Code of Federal Regulations (CFR) 1926.552 and guidelines contained in the Wire Rope User's Manual published by the American Iron and Steel Institute shall be used whenever wire line hoists, wire rope, or hoisting hardware are used. The driller should provide written reports (upon request) documenting inspections of equipment.

H. Traffic Safety

Drilling in streets, parking lots or other areas of vehicular traffic requires definition of the work zones with cones, warning tape, etc. and compliance with local police requirements.

I. Fire Safety

- Fire extinguishers (type ABC) shall be kept on or near drill rigs for fighting small fires.
- If methane or other flammable gases or vapors are suspected in the area, a combustible gas indicator (CGI) shall be used to monitor the air near the borehole with all work to stop at 20 percent of the Lower Explosive Limit (LEL).
- Work shall stop during lightning storms.

J. Protective Gear

1. Minimum Protective Gear

Items listed below should be worn by all staff working within 30 feet (10 meters) of drilling activities.

- Hearing Protection;
- Hard Hat;
- Eye Protection (safety glasses, goggles, or face-shield)
- Safety Shoes (shoes or boots with steel toes)

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2. Other Gear

Items listed below should be worn when conditions warrant their use. Some of the conditions are listed after each item.

- **Safety Harnesses and Lifelines:** Safety harnesses and lifelines shall be worn by all persons working on top of an elevated derrick beam or mast. The lifeline should be secured at a position that will allow a person to fall no more than six feet (2 meters). OSHA Fall Protection (1926 Subpart M) requirements apply.
- **Life Vests:** Use for work over water.

5. Resources

- A. International Association of Drilling Contractors Safety Alerts
<http://iadc.org/alerts.htm>
- B. Fall Protection - SMS 040
- C. Hearing Conservation - SMS 026
- D. Subcontractor Health and Safety Requirements - SMS - 046
- E. Utility Clearances and Isolation - SMS 034

URS SAFETY MANAGEMENT STANDARD **Vehicle Safety Program**

1. Applicability

This procedure applies to URS Corporation's U.S. operations. A violation of this policy is subject to disciplinary action up to and including termination.

2. Purpose and Scope

The purpose of this procedure is to help insure that people driving for the URS Corporation do so in a safe manner.

This Safety Management Standard (SMS) applies to employees operating motor vehicles that are owned, rented or leased by the Company, and the use of personal vehicles while on Company business.

This SMS does not apply to heavy equipment operations (see SMS 019).

3. Implementation

The overall responsibility for program implementation is with the URS Health and Safety Director. Other responsibilities include:

Administration - Fleet management, Vehicle Safety Program, vehicle acquisition, insurance claims reporting, controlling access to vehicles, maintenance of vehicles, participating on accident review.

Human Resources - Documentation of driver's license, discipline.

Health and Safety - Employee safety training, maintenance of the vehicle safety program, participation on the accident review committee.

Employee - Familiarization with URS Vehicle Safety Program, compliance with its requirements.

4. Requirements

A. Authorized Drivers

1. Authorized Drivers are those individuals permitted to drive URS owned, leased, or rented vehicles. Employees that only operate rental cars obtained on a daily basis through URS National Service Agreements are not required to be designated as Authorized Drivers.
2. Must be at least 18 (non-commercial license) or 21 (commercial license) years of age and have a current driver's license for the appropriate class of vehicle (unless more stringent requirements are established by the leasing/renting agency).
3. Human Resources and Office Administrators requires new employees and current employees (on an annual basis), designated as Authorized Drivers, to provide a copy of their driver's license. Authorized drivers who

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lose their license through legal action must notify their Human Resources Representative immediately. The Human Resources Representative will notify the Fleet Manager.

4. The Company may suspend the privilege to operate vehicles on Company business due to non-compliance with the URS Vehicle Safety Program, involvement in a motor vehicle accident, or motor vehicle violations.
5. Authorized drivers must review the Vehicle Safety Program (SMS 057) and sign the Drivers Information form (Attachment 57-2).
6. Non-URS employees (e.g., subcontractors, alliance partners) may operate URS vehicles only when this activity is specifically agreed to in the applicable contract.

B. Training

1. Authorized Drivers shall be provided basic driver safety training, including a review of the URS Vehicle Safety Program (SMS 057) and video or on-line training, within 6 months of the effective date of this SMS or within 3 months of their hire date.
2. Additional training may be required for select employees based on accident involvement.

C. General Operating Policy and Procedure (Applies to Authorized and Non-Authorized Drivers Operating Motor Vehicles on Official Company Business)

1. Company owned/rented/leased motor vehicles may be operated only by properly licensed employees who are specifically authorized to drive Company vehicles.
2. Authorized drivers required to operate vehicles with special hazards (i.e. trucks carrying fuel cells, vehicles used to tow trailers, vehicles with limited visibility, etc.) shall be thoroughly briefed on the hazards and control measures necessary for safe operation of the vehicle. The local office shall maintain documentation of the briefing.
3. Drivers/operators shall know and obey all federal, state and local motor vehicle laws applicable to the operation of their vehicle.
4. A driver shall not permit unauthorized persons to operate a Company-owned/rented/leased vehicle.
5. URS policy regarding reimbursement and insurance coverage requirements for use of personal automobiles may be found in the Policy and Procedures Manual (Section 074.020).
6. All cargo extending 4 feet or more beyond the end of a truck, trailer or similar vehicle shall be clearly marked with a red warning flag or cloth measuring no less than 16 inches square. Red lights must be used at night.

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7. Company owned/rented/leased vehicles are for official business use only and are not to be used for personal activities without the specific approval of a Division Manager, Senior Vice President, or above.
8. Seat belts and shoulder harnesses (occupant restraint systems) shall be worn or used whenever the vehicle is in operation. The vehicle may not move until all passengers have fastened their restraints.
9. When parking or leaving a vehicle, the following procedures must be followed: Shut off the engine, engage the transmission in park (automatic transmission) or first gear (standard transmission), set the parking brake, remove the ignition keys, and lock the vehicle.
10. The vehicle's engine is to be turned off during refueling. Smoking or cell phone use is not allowed while refueling.
11. Drivers/operators will not drive or operate vehicles while under the influence of alcohol or illegal drugs. Further details on the URS Substance Abuse Policy may be found in the Policy and Procedure Manual (section 034.030).
12. Drivers/operators will not drive or operate vehicles while under the influence of medications when told by a physician, another healthcare provider, or the manufacturer (i.e. instructions on the label) that the activity is unsafe.
13. Vehicle operators are responsible for any fines levied by law enforcement agencies for the operation of their vehicles.
14. Articles, tools, equipment, etc. placed in vehicles shall be stored as not to interfere with vision or the proper operation of the vehicle in any way. This also includes preventing items from flying about or out of the vehicle during sudden stops, turning, etc.
15. Trucks or vehicles with obstructed rear-view mirrors must observe the following procedures when backing up: Position an employee to act as a spotter at the rear of the vehicles, in the driver's line of sight, to ensure that the area behind the truck is clear. If no other employee is present, then the driver must step out of the vehicle and check the area behind the vehicle before backing up. As an added precaution, avoid backing up whenever possible.
16. Driver/operators may not deactivate or muffle any backup warning device.

D. Field Site Vehicle Safety

1. Define specific vehicle travel routes and parking areas at field sites. Use fencing, cones or other markings to define roads and parking.
2. If parking on the shoulder of an active road, park as far off the road as possible.
3. If work is required alongside an active road (e.g., surveying) park the vehicle behind the area of work to provide a barrier against out-of-control vehicles.

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4. URS will not transport DOT-placard quantities of hazardous materials. However, small quantities of hazardous materials (e.g., sample coolers) may be transported if properly packaged. Be careful to prevent chemical contamination of the vehicle. Further details on DOT shipping may be found in the DOT Shipping SMS 048.
5. Nuclear density meters (e.g., Troxler units) may be transported only by employees who have been trained in the use of nuclear density meters (see SMS 044). Nuclear density meters must be secured from movement and locked during transport. NRC and state-specific regulations regarding transport documentation also apply.
6. When performing fieldwork requiring the blocking of traffic lanes (e.g., bridge inspection), follow URS SMS 032, the Manual on Uniform Traffic Control Devices for Streets and Highways (ANSI D6.1) and local police requirements for barriers, cones, and flaggers.
7. No employee may ride in the bed of a pickup truck unless seating and restraints are provided for this specific use.

E. Accident Response and Reporting

1. In case of injury, call or have someone else call, 911 immediately for emergency assistance. If you are involved in an accident and are not injured, do the following:
 - a. Protect the accident scene.
 - b. Do not admit liability or place any blame for the accident.
 - c. Provide only your name, address, driver's license number, and vehicle insurance information.
 - d. Obtain the following:
 - i. name(s), addresses, and telephone number(s) of the owner
 - ii. driver and occupants of other vehicle(s)
 - iii. the owner's insurance company
 - iv. driver's license number
 - v. year, make, model and license number of the vehicle(s)
 - vi. name(s) and addresses of any witnesses
 - e. **DO NOT:**
 - Call the insurance company; the Fleet Manager's office will do this (unless the incident involves your personal vehicle).
 - Give a statement to the press.
 - Give a signed statement to the claims adjuster representing the other driver's insurance company.

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NOTE: The Auto Claim Report (Attachment 57-1) for Company-leased or owned vehicles is located in the vehicle glove compartment. The driver must complete this form at the scene of the accident and submit it to management.

2. Notification

All accidents with a Company-leased, rented, or owned vehicle must be reported to your Office/Branch Manager/Supervisor and Fleet Manager within 24-hours of the time it occurs. Use the Auto Claim Report (Attachment 57-1) for this purpose. The Fleet Administrator will report the accident to the insurance carrier (leased and owned vehicles only) promptly.

F. Accident Review

1. The Fleet Manager will review all accidents involving URS-owned, rented or leased vehicles. Accidents involving any of the following will result in immediate disciplinary action in coordination with Human Resources:
 - a. Driving under the influence of alcohol or illegal drugs
 - b. Reckless driving
 - c. Driving without a license
 - d. Hit-and-run driving
 - e. Repeat accidents involving the same employee,
 - f. Unauthorized use of Company vehicles.
2. Disciplinary action includes possible:
 - a. Loss of URS driving privileges
 - b. Additional driver safety training
 - c. Suspension without pay
 - d. Termination

G. Inspection

1. The driver is responsible for inspecting the vehicle prior to use and not driving a vehicle with obvious safety defects.
2. Basic safety checks must include:
 - a. Tire condition/pressure
 - b. Lights/turn signals
 - c. A clean windshield and adequate window washer fluid
 - d. Gauges/warning lights indicating a normal condition
 - e. Mirrors properly adjusted
 - f. Brakes with adequate pedal pressure for proper braking

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3. Any defects must be reported to the local office Fleet Representative/Office Administrator.

H. Vehicle Maintenance

1. The Office Administrator (or designee) is to ensure that all URS-leased/owned vehicles are properly maintained.
2. Routine maintenance must be performed in accordance the schedule provided in the owner's manual stored in the vehicle.
3. Reported defects/problems with vehicles must be repaired promptly.

5. Documentation Summary

- A. Auto Claim Report - (Attachment SMS 57-1)
- B. Driver's Information - (Attachment SMS-57-2)

6. References

The following sites provide additional information to assist you:

- A. National Safety Council; Information on Defensive Driving Courses
<http://www.nsc.org/psg/ddc.htm>
- B. AAA Foundation for Traffic Safety
<http://www.aaafoundation.org/>

URS SAFETY MANAGEMENT STANDARD

Cold Stress

1. Applicability

This procedure applies to URS projects where field crews are working outdoors in damp and cool (below 50° F or 10°C) conditions or anytime temperatures are below 32°F or 0°C.

2. Purpose and Scope

The purpose of this procedure is to protect project personnel from the following conditions:

Hypothermia: Hypothermia results when the body loses heat faster than it can be produced. When this situation first occurs, blood vessels in the skin constrict in an attempt to conserve vital internal heat. Hands and feet are first affected. If the body continues to lose heat, involuntary shivers begin. This is the body's way of attempting to produce more heat, and it is usually the first real warning sign of hypothermia. Further heat loss produces speech difficulty, confusion, loss of manual dexterity, collapse, and finally death. Wet clothes or immersion in cold water greatly increases the hypothermia risk. The progressive clinical presentation of hypothermia may be seen in Attachment 59-1.

Frostbite: Local injury resulting from cold is included in the generic term frostbite. There are several degrees of damage. Frostbite can be categorized into:

- **Frost Nip or Initial Frostbite:** (1st degree frostbite) Characterized by blanching or whitening of skin.
- **Superficial Frostbite:** (2nd degree frostbite) Skin has a waxy or white appearance and is firm to the touch, but tissue beneath is resilient. Blistering and peeling of the frozen skin will follow exposure.
- **Deep Frostbite:** (3rd degree frostbite) Tissues are cold, pale, and solid; extremely serious injury with possible amputation of affected area.

Frostbite can occur without hypothermia when the extremities do not receive sufficient heat. The toes, fingers, cheeks, and ears are the most commonly affected. Frostbite occurs when there is freezing of the fluids around the cells of the affected tissues. The first symptom of frostbite is an uncomfortable sensation of coldness, followed by numbness. There may be tingling, stinging, or cramping. Contact by the skin with tools or other metal objects below 20°F (-7°C) may result in contact frostbite.

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3. Implementation

Field Activities - Implementation of this procedure is the responsibility of the Project Manager and the field supervisor.

4. Requirements

- A. Carefully plan work anticipated to be performed in cool or cold conditions. Include costs in project budgets for specialized equipment and supplies needed to complete the field activities.
- B. Monitor weather forecasts immediately prior to entering the field.
- C. Observe and monitor weather conditions such as ambient temperature, wind speed, and precipitation while in the field. Use Attachment 59-2 to determine wind chill.
- D. Wear at least 3 layers of clothing.

- An outer layer to break the wind and allow some ventilation (e.g., Gortex® or nylon)
- A middle layer of down, wool, or similar materials to provide insulation
- An inner layer of cotton or synthetic weave to allow ventilation

In addition:

- Wear a hat. Up to 40% of body heat can be lost when the head is left exposed.
- Wear insulated boots or other insulated footwear.
- Keep a change of dry clothing available in case work clothes become wet.
- Do not wear tight clothing. Loose clothing allows better ventilation.

E. Use the following work practices:

- Use Attachment 59-3 to establish work/rest cycles in cold weather.
- Drink plenty of warm liquids. It is easy to become dehydrated in cold

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weather.

- Avoiding caffeine and alcohol. Alcohol will accelerate loss of body heat.
- Eat high calorie snacks to help maintain body metabolism.
- If possible, heavy work should be scheduled during the warmer parts of the day. Take breaks out of the cold.
- Work in pairs to keep an eye on each other and watch for signs of cold stress.
- NEVER IGNORE SHIVERING. Persistent or violent shivering is a clear warning that you are on the verge of hypothermia.
- Avoid exhaustion.

F. When possible, use the following engineering controls:

- Provide shelter to escape cold, wind and precipitation
- Provide a source of heat (such as warm packs or portable heaters)
- Use insulating materials on equipment handles when temperatures drop below 30°F or -1°C.

G. Watch for symptoms and signs of hypothermia (see Attachment 59-1).

H. Treat cold stress illness as follows:

- Hypothermia: Prompt treatment of hypothermia is essential. Once the body temperature drops below 95°F or 35°C, the loss of temperature control occurs, and the body can no longer rewarm itself. Initial treatment includes reducing heat loss by moving the individual out of the wind and cold, removal of wet clothing, applying external heat (such as a pre-warmed sleeping bag, electric blanket, or body-heat from other workers) and follow-up medical attention.
- Frost Bite: The initial treatment for frostbite includes bringing the individual to a warm location, removal of clothing in the affected area, and, **if help is delayed**, placing the affected parts in warm (100° to 104° F or 38° to 40°C) water. Do not massage or rub the frostbite area. After

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the initial treatment, wrap the affected area loosely in sterile gauze and seek medical attention.

For further discussion on Cold Stress treatment, please refer to Attachment 59-1

I. Hypothermia in Water:

Loss of body heat to the water is a major cause of deaths in boating accidents. Often the cause of death is listed as drowning; however the primary cause is often hypothermia. It should also be noted that alcohol lowers the body temperature around two to three degrees by dilating the blood vessels. Do not drink alcohol around cold water. The following table shows the effects of hypothermia in water:

WATER TEMPERATURE	EXHAUSTION	SURVIVAL TIME
32.5° F (0°C)	Under 15 min.	Under 15 to 45 min.
32.5 to 40°F (0 – 4°C)	15 to 30 min.	30 to 90 min.
40 to 50°F (4 – 10°C)	30 to 60 min.	1 to 3 hrs.
50 to 60°F (10 – 16°C)	1 to 2 hrs.	1 to 6 hrs.
60 to 70°F (16 – 21°C)	2 to 7 hrs.	2 to 40 hrs.
60 to 70°F (16 – 21°C)	3 to 12 hrs.	3 hrs. to indefinite
Over 80°F (27°C)	Indefinite	Indefinite

SOME POINTS TO REMEMBER:

- Wear your PFD. Review SMS 053 - Marine Safety and Boat Operations.
- If water is less than 50°F (10°C), wear a wet suit or dry suit for work in water (e.g., wading) or if significant potential to fall in water.
- While in the water, do not attempt to swim unless to reach nearby safety. Unnecessary swimming increases the rate of body heat loss. Keep your head out of the water. This will increase your survival time.

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- Keep a positive attitude about your rescue. This will increase your chances of survival.
- If there is more than one person in the water, huddling is recommended.

J. Training

Workers at risk of developing hypothermia or cold-related injury will be trained in:

- recognition of the signs and symptoms of cold injury or impending hypothermia,
- proper re-warming procedures and appropriate first aid treatment,
- proper use of clothing,
- proper eating and drinking practices
- safe work practices appropriate to the work that is to be performed.

5. Documentation Summary

File these records in the Project Safety File.

- A. Completed Project Hazard Analysis form (see Health and Safety Website – "Hazard Analysis")
- B. Cold stress training records

6. Resources

- A. OSHA Fact Sheets – "Protecting Workers in Cold Environments"
http://www.osha-slc.gov/OshDoc/Fact_data/FSNO98-55.html
- B. Attachment 59-1 "Signs of, and Treatment for, Cold Stress related Illnesses"
- C. Attachment 59-2(a) "Wind Chill Index" (units in °F and miles/hour)
- D. Attachment 59-2(b) "Wind Chill Index" (units in °C and Kilometers/hour)
- E. Attachment 59-3 "TLVs Work/Warm-up Schedule for Outside Workers based on a Four-hour Shift"

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Attachment 59-1 Signs of and Treatment for Cold Stress Related Illnesses

Condition	Signs/Symptoms	Treatment
Hypothermia Mild (98° - 90° F) (36° - 32°C)	<ul style="list-style-type: none"> • shivering • lack of coordination • stumbling, fumbling hands • slurred speech • memory loss • pale, cold skin 	<ul style="list-style-type: none"> • move to warm area • stay active • remove wet clothes and replace with dry clothes or blankets • cover the head • drink warm (not hot) sugary drink
Hypothermia Moderate (90° - 86° F) (32° - 30°C)	<ul style="list-style-type: none"> • shivering stops • unable to walk or stand • confused and irrational 	<ul style="list-style-type: none"> • All of the above, plus • Call for an ambulance • Cover all extremities completely • Place very warm objects, such as hot packs or water bottles on the victim's head, neck, chest and groin
Hypothermia Severe (86° - 78° F) (30° - 26°C)	<ul style="list-style-type: none"> • severe muscle stiffness • very sleepy or unconscious • ice cold skin • death 	<ul style="list-style-type: none"> • Call for an ambulance • Treat the victim very gently • Do not attempt to re-warm -- the victim should receive treatment in a hospital
Frostbite	<ul style="list-style-type: none"> • Cold, tingling, stinging or aching feeling in frostbitten area; numbness • Skin color turns red, then purple, then white or very pale skin, cold to the touch • Blisters in severe cases 	<ul style="list-style-type: none"> • Seek medical attention • Do not rub the area • Wrap in soft cloth • If help is delayed, immerse in warm, not hot, water
Trench Foot	<ul style="list-style-type: none"> • Tingling, itching or burning sensation • Blisters 	<ul style="list-style-type: none"> • Soak feet in warm water, then wrap with dry cloth bandages • Drink a warm, sugary drink

Source: Princeton University, Department of Environmental Health and Safety, posted 2/2/99.

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Attachment 59-2(a)
Wind-Chill Index¹
(miles per hour and °F.)

	ACTUAL THERMOMETER READING (°F)									
	50	40	30	20	10	0	-10	-20	-30	-40
Wind speed in mph	EQUIVALENT TEMPERATURE (°F)									
calm	50	40	30	20	10	0	-10	-20	-30	-40
5	48	37	27	16	6	-5	-15	-26	-36	-47
10	40	28	16	4	-9	-21	-33	-46	-58	-70
15	36	22	9	-5	-18	-36	-45	-58	-72	-85
20	32	18	4	-10	-25	-39	-53	-67	-82	-96
25	30	16	0	-15	-29	-44	-59	-74	-88	-104
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116
Over 40 mph (little added effect)	Little Danger (for properly clothed person)				Increasing Danger (Danger from freezing of exposed flesh)			Great Danger		

¹ Source: Fundamentals of Industrial Hygiene, Third Edition. Plog, B.A., Benjamin, G.S., Kerwin, M.A., National Safety Council, 1988

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Attachment 59-2(b)
Wind-chill Index¹
(Kilometers per hour and °C.)

Estimated wind speed (in km/h)	Actual temperature reading (°C)													
	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	
0 (Calm)	10	5	0	-5	-10	-15	-20	-25	-30	-35	-40	-45	-50	
8	9	3	-2	-7	-12	-18	-23	-28	-33	-38	-44	-49	-54	
16	4	-2	-7	-14	-20	-27	-33	-38	-45	-50	-57	-63	-69	
24	2	-5	-11	-18	-25	-32	-38	-45	-52	-58	-65	-72	-78	
32	0	-7	-14	-21	-28	-35	-42	-50	-56	-64	-71	-78	-84	
40	-1	-8	-16	-24	-31	-38	-46	-53	-60	-67	-76	-82	-90	
48	-2	-10	-17	-25	-33	-40	-48	-55	-63	-70	-78	-86	-94	
56	-3	-11	-18	-26	-34	-42	-50	-58	-65	-73	-81	-89	-96	
64	-3	-11	-19	-27	-35	-43	-51	-59	-66	-74	-82	-90	-98	
(Wind speeds greater than 64 km/h have little additional effect.)	LOW HAZARD Risk of exposed, dry skin being affected in less than one hour. Awareness of hazard low.				INCREASING HAZARD Danger from freezing of exposed flesh within one minute.				HIGH HAZARD Flesh may freeze within 30seconds.					

The table was originally developed by the U.S. Army Research Institute of Environmental Medicine, Natick, MA, and is adapted from the 1995-1996 *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, published by the ACGIH. The ACGIH publication provides the equivalent table with temperature in degrees Fahrenheit and wind speed in mph.

Equivalent chill temperature requiring dry clothing to maintain core body temperature above 36°C (96.8°F).

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Attachment-59-3

TLVs Work/Warm-up Schedule for Outside Workers based on a Four-hour Shift*

The ACGIH has adopted the guidelines developed by the Saskatchewan Labour for working outdoors in cold weather conditions. These guidelines recommend protective clothing and limits on exposure time. The recommended exposure times are based on the wind chill factor, a scale based on air temperature and wind speed. The work-break schedule applies to any four-hour period with moderate or heavy activity. The warm-up break periods are of 10-minute duration in a warm location. The schedule assumes that "normal breaks" are taken once every two hours. At the end of a 4-hour period, an extended break (e.g. lunch break) in a warm location is recommended. More information is available in the ACGIH publications "2000 TLVs and BEIs" and "Documentation of TLVs and BEIs" and on the Saskatchewan Labour web page "[Cold Conditions Guidelines for Outside Workers](#)".

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
°C (approx.)	°F (approx.)	Max. work Period	No. of Breaks*	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks	Max. Work Period	No. of Breaks
-26° to -28°	-15° to -19°	(Norm breaks) 1		(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4
-29° to -31°	-20° to -24°	(Norm breaks) 1		75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32° to -34°	-25° to -29°	75 min.	2	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease	
-35° to -37°	-30° to -34°	55 min.	3	40 min.	4	30 min.	5	Non-emergency work should cease			
-38° to -39°	-35° to -39°	40 min.	4	30 min.	5	Non-emergency work should cease					
-40° to -42°	-40° to -44°	30 min.	5	Non-emergency work should cease							
-43° & below	-45° & below	Non-emergency work should cease									

*2000 TLVs and BEIs - Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati : American Conference of Governmental Industrial Hygienists (ACGIH), 2000 - page 176. Adopted from Saskatchewan Labour "[Cold Conditions Guidelines for Outside Workers](#)"

URS SAFETY MANAGEMENT STANDARD

HAND SAFETY

1. Applicability

This program applies to URS Corporation office and field operations where hand safety is a concern.

2. Purpose and Scope

This procedure is intended to protect employees from activities that might or could expose them to injury. This procedure provides information on recognizing those conditions that require personal protective equipment or specific work practices to reduce hand injury risk.

3. Implementation

Office locations: The implementation of this program is the Office Manager's responsibility, with support from the URS Local Health and Safety Representative.

Field Activities: Implementation of this program is the Project Manager(s)' responsibility.

4. Requirements

A. Personal Protective Equipment

1. Perform hazard assessments for those work activities likely to require PPE.
 - a. Use SMS 29-1 (PPE Hazard Assessment Certification Form) to perform the assessment. The Hazard Assessment Certification Form shall accompany URS personnel at job sites for use in the event of a job or task change.
 - b. Reevaluate completed hazard assessments when the job or task changes.
2. If possible, eliminate the hazards identified through engineering or administrative controls. Examples of controls are: chemical substitution, machine guarding, and use of different tools.
3. Select PPE that will protect employees if hazards cannot be eliminated.
 - a. Review Material Safety Data Sheets for project or task-specific chemicals to determine appropriate PPE. If needed, consult with the URS Health and Safety Representative for assistance.

URS SAFETY MANAGEMENT STANDARD HAND SAFETY

- b. Review glove manufacturer recommendations for both physical and chemical protection.
 - c. Obtain gloves of the correct size for project field staff
 - d. When both chemical and physical protection are of concern, the chemical protection gloves (e.g. nitrile) shall be worn inside the physical protection gloves (e.g. leather, Kevlar®).
 - e. Latex gloves are not recommended for chemical protection.
- B. Guidelines for Working With and Around Equipment (Hand Tools, Portable Equipment)
 - 1. General
 - a. Keep hand and power tools in good repair and used only for the task for which they were designed.
 - b. Remove damaged or defective tools from service.
 - c. Do not remove or bypass a guarding device for any reason.
 - d. Keep surfaces and handles clean and free of excess oil to prevent slipping.
 - e. Wear proper PPE, including gloves, as necessary.
 - f. Do not carry sharp tools in pockets.
 - g. Clean tools and return to the toolbox or storage area upon completion of a job.
 - h. Wrenches must have a good bite before pressure is applied.
 - i. Brace yourself by placing your body in the proper position so that in case the tool slips you will not fall.
 - ii. Make sure hands and fingers have sufficient clearance in the event the tool slips.
 - iii. Always pull on a wrench, never push.
 - i. When working with tools overhead, place tools in a holding receptacle when not in use.

URS SAFETY MANAGEMENT STANDARD **HAND SAFETY**

- j. Do not throw tools from place to place, from person to person, or drop from heights.
 - k. Inspect all tools prior to start-up or use to identify any defects.
 - l. Powered hand tools should not be capable of being locked in the on position.
 - m. Require that all power-fastening devices be equipped with a safety interlock capable of activation only when in contact with the work surface.
 - n. Do not allow loose clothing, long hair, loose jewelry, rings and chains to be worn while working with power tools.
 - o. Do not use cheater pipes.
 - p. Make provisions to prevent machines from restarting through proper lockout/tagout (refer to SMS 023 – Lockout and Tagout Safety).
2. Cutting Tools
- a. Hand cutting tools such as knives, scissors, paper cutters, etc. should be used with care and in the manner intended by the manufacturer.
 - b. Personnel when utilizing cutting tools should observe the following precautions to the fullest extent possible:
 - i. Use the correct tool and correct size tool for the job,
 - ii. Cut in a direction away from yourself and not towards other workers in the area,
 - iii. Maintain the non-cutting hand and arm towards the body and out of the direction of cutting tool if it were to slip out of the material being cut.
 - iv. Ensure that the tool is sharp and clean; dirty and dull tools typically cause poor cuts and more hazard than a sharp clean cutting tool
 - v. Store these tools correctly with covers in-place or blades retracted as provided by the manufacturer.

URS SAFETY MANAGEMENT STANDARD **HAND SAFETY**

- vi. On tasks where cutting may be very frequent or an all day task (e.g., liner samples), Kevlar® gloves should be considered in the PPE evaluation for the project.
- vii. Do not remove guards on paper cutters.

3. Moving/Rotating Equipment

a. General Requirements for Drilling

- i. Require a meeting at project start-up regarding the drill rig operator responsibility for rig safety and any site and equipment specific safety requirements. The significant potential for hand injuries (including finger amputation) in drilling operations requires proper work practices and well-maintained equipment.
- ii. Set up any sample tables and general work areas for the URS field staff to the side of the drill rig (preferably 10 meters away) and not directly behind the rig.
- iii. URS engineers, technician, and geologists shall not assist drillers with the drilling equipment or supplies and shall not at any time operate the drill rig controls.
- iv. Do not wear loose clothing or jewelry while working near rotating equipment.

b. Safe Use of Augers (Drilling work)

- i. When the drill is rotating, stay clear of the drill string and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.
- ii. Move auger cuttings away from the auger with a long-handled shovel or spade; never use hands.
- iii. Never clean an auger attached to the drill rig unless the transmission is in neutral or the engine is off, and the auger has stopped rotating.

c. Other Rotating Equipment (feed augers, chippers, conveyors, etc.)

- i. Never place hands, fingers, extremities near hoppers and operational areas of machinery.
- ii. When the equipment is rotating, stay clear of the rotating components and only operate equipment with proper machine guarding in place.

URS SAFETY MANAGEMENT STANDARD **HAND SAFETY**

- iii. Never clean a jammed piece of equipment unless the transmission is in neutral and the power source or the engine is off, and the moving parts of the equipment have stopped rotating. Refer to SMS 23, Lockout and Tagout Safety.

4. Power Saws

- a. Require that circular saws are fitted with blade guards.
- b. Remove damaged, bent or cracked saw blades from service immediately.
- c. Require that table saws be fitted with blade guards and a splitter to prevent the work from squeezing the blade and kicking back on the operator.
- d. Require guards that cover the blade to the depth of the teeth on hand held circular saws. The guard should freely return to the fully closed position when withdrawn from the work surface.

5. Pneumatic Tools and Equipment

- a. Require that pneumatic tools have:
 - i. Tool retainers to prevent the tool from being ejected from the barrel during use.
 - ii. Safety clip or tie wire to secure connections between tool/hose/compressor if they are of the quick connection (Chicago fittings) type.
- b. Never use compressed air to blow dirt from hands, face or clothing.
- c. Compressed air exhausted through a chip-guarded nozzle shall be reduced to less than 30 psi. Proper respiratory, hand, eye and ear protection must be worn.
- d. Never raise or lower a tool by the air hose.

6. Chain Saws

- a. Inspect the saw prior to each use and periodically during daily use. Refer to the manufacturer's manual for an inspection checklist.
- b. Operate the chain saw with both hands at all times.

URS SAFETY MANAGEMENT STANDARD **HAND SAFETY**

- c. Never cut above chest height.
- d. Require that the idle is correctly adjusted on the chain saw. The chain should not move when the saw is in the idle mode.
- e. Start cutting only after a clear escape path has been made.
- f. Shut the saw off when carrying through brush or on slippery surfaces. The saw may be carried no more than 50 feet (15 meters) while idling.
- g. Require applicable protective gear.
 - i. Loggers safety hat.
 - ii. Safety glasses.
 - iii. Steel-toed boots.
 - iv. Protective leggings.
 - v. Hearing protection.
- h. Inspect saws to ensure that they are fitted with an inertia break and hand guard.
- i. Never operate a chain saw when fatigued.
- j. Do not allow others in the area when chain saws are operated.
- k. Make sure there are no nails, wire or other imbedded material that can cause flying particles.
- l. Do not operate a chain saw that is damaged, improperly adjusted, or is not completely and securely assembled. Always keep the teeth sharp and the chain tight. Worn chains should immediately be replaced.
- m. Keep all parts of your body away from the saw chain when engine is running.

7. Hand Operated Pressure Equipment

- a. High-pressure water/steam sprayers or cleaners should be used and handled as directed by the manufacturer. Hands should not be cleaned utilizing this equipment.

URS SAFETY MANAGEMENT STANDARD **HAND SAFETY**

- b. Pressure equipment such as grease guns, paint and garden sprayers shall be directed away from the body and other personnel in the area.
- c. Never allow the nozzle of a pressurized tool to come in contact with any body parts while operating. There is potential for injection of a chemical directly into the user's body, resulting in severe injury or death.

8. Physical Hazards – Non-tool

- a. Activities such as drum handling, fencing, work near razor-wire, manhole cover removal and demolition also pose hazards to hands
- b. The SMS 29 - Personnel Protective Equipment should be utilized to determine what type of PPE will be needed for a job.
- c. Plan work to avoid pinch points for hands when moving drums, moving man-hole covers back in to position, and handling other heavy objects.
- d. Work handling scrap metal or other sharp edges requires proper hand PPE (Kevlar® or leather gloves).

C. Ergonomics - Hand & Wrist Care

- 1. Keep your wrist in neutral. Avoid using your wrist in a bent (flexed), extended, or twisted position for long periods of time. Instead try to maintain a neutral (straight) wrist position. Ergonomic tools may be needed for long-term work.
- 2. Watch your grip. Gripping, grasping, or lifting with the thumb and index finger can put stress on your wrist. When practical, use the whole hand and all the fingers to grasp an object.
- 3. Minimizing repetition. Even simple, light tasks may eventually cause injury. If possible, avoid repetitive movements or holding an object in the same way for extended periods of time.
- 4. Reduce speed and force. Reducing the speed with which you do a forceful, repetitive movement gives your wrist time to recover from the effort. Using power tools helps reduce the force.
- 5. Rest your hands. Periodically give your hands a break by letting them rest briefly. Or you may be able to alternate easy and hard tasks, switch hands, or rotate work activities.

URS SAFETY MANAGEMENT STANDARD **HAND SAFETY**

D. Biological Impacts

1. Poisonous Plants

- a. Personnel in regions where potential contact with poisonous plants should be aware of the hazard.
 - i. Avoid contact
 - ii. Wear appropriate PPE
 - iii. Thorough hand cleaning after impact prior to further work tasks

2. Further information can be obtained from the SMS 47 - Biological Hazards

E. Cleaning Hands

- 1. Avoid contamination of hands by proper use of gloves when contact with physical, chemical, or biological hazards is possible.
- 2. Use soap and water for normal hand cleaning. Do not use solvents for cleaning as they remove essential oils in the skin and may cause dermatitis. Do not use pressure washers for hand cleaning.
- 3. If the hands contact a corrosive (e.g. nitric acid), wash the area with water for fifteen minutes and then seek medical attention.
- 4. Use antibiotic ointment and skin protection on minor breaks/scratches of the skin.

5. Resources

- A. SMS 16 - Hand Tools and Portable Equipment
- B. SMS 29 - Personal Protective Equipment
- C. SMS 54 - Office Ergonomics
- D. SMS 56 - Drilling Safety Guidelines

URS Corporation

URS Corporation Health & Safety Program HAZARD ASSESSMENT CERTIFICATION FORM

Location: _____ Job No: _____

Date : _____ Assessment Conducted by: _____

Specific tasks performed at this location: _____

Are any of the following present during the task?		No	Yes (Hazard Present)	Eliminate Hazard or Use Following PPE
Overhead Hazards				
1.	Suspended loads that could fall			Hard hat, ANSI Class A, B
2.	Overhead beams or load that could strike head			Hard hat, ANSI Class A, B
3.	Energized wires or equipment that could strike head			Hard hat, ANSI Class B
4.	Employees working above at an elevated site who could drop objects on others below			Hard hat, ANSI Class A, B
5.	Sharp objects or corners at head level			Hard hat, ANSI Class A, B or C
Eye Hazards				
6.	Chemical splashes or irritating mists			Chemical protective goggles See Attachment 29-3
7.	Excessive dust			Safety glasses or impact goggles
8.	Smoke & fumes			Chemical protective goggles
9.	Welding operations			See Attachment 29-3 and 29 T-1
10.	Lasers/optical radiation			See Attachment 29-3 and Reference F
11.	Projectiles			See Attachment 29-3
12.	Sawing, cutting, chipping, grinding			See Attachment 29-3
Face Hazards				
13.	Chemical splashes or irritating mists			Face shield if chemical is irritating to the skin or is corrosive. See Attachment 29-3
14.	Welding operations			See Attachment 29-3 and 29-T1
15.	Projectiles			See Attachment 29-3 and face shield
Hand Hazards				
16.	Chemical exposure			Use resistant gloves as recommended by manufacturer - See Best Chemrest Guide
17.	Sharp edges, splinters, etc.			Leather gloves

Location : _____ Job No: _____

Are any of the following present during the task?		No	Yes (Hazard Present)	Eliminate Hazard or Use Following PPE
18.	Temperature extremes - heat			Leather gloves; hot mill gloves; Kevlar gloves, welders' gloves
19.	Temperature extremes - cold			Leather gloves; insulated gloves
20.	Blood, fungus			Nitrile gloves
21.	Exposure to live electrical current			Electrical gloves - See Reference H
22.	Sharp tools, machine parts, etc.			Leather gloves, kevlar gloves
23.	Material handling			Leather gloves
Foot Hazards				
24.	Heavy materials (greater than 50 pounds) handled by employees			Safety shoes or boots
25.	Potential to crush whole foot			Safety shoes or boots with metatarsal guard
26.	Sharp edges or points - puncture risk			Safety shoes or boots
27.	Exposure to electrical wires			Safety shoes or boots with electrical protection
28.	Unusually slippery conditions			Rubber soled boots or grips
29.	Chemical contamination			Rubber, nitrile boots or boot covers
30.	Wet conditions			Rubber boots or boot covers
31.	Construction/demolition			Safety shoes or boots with metatarsal guard if who foot crushing hazard exists.
Fall Hazards				
32.	Elevations above 6 feet without guardrails			Full body harness, ANSI A-10.14 - 1991 - See Reference G
33.	Suspended scaffolds, boatswain's chairs, float scaffolds, suspended staging.			ANSI Type II - full body harness - See Reference G
34.	Working in trees			ANSI Type I full body harness - See Reference G
35.	Working in vehicle mounted, elevating work platforms (bucket trucks, pin-on platforms, etc.)			ANSI Type II full body harness - see Reference G
Water Hazards				
36.	Working on or above water where drowning hazards exist			U.S. Coast Guard approved personal flotation device, Type I, II, or III PFD
Excessive Heat or Flame				
37.	Full body chemical protective clothing in temperatures greater than 80 degrees			Cooling vest
38.	Work around molten metal or flame			Nomex or kevlar clothing

Location : _____ Job No: _____

Are any of the following present during the task?		No	Yes (Hazard Present)	Eliminate Hazard or Use Following PPE
39.	Welding activities			Welding leathers for those areas that are exposed to flame, spark or molten metal
Respiratory Hazards				
40.	See SMS for RESPIRATORY PROTECTION for selection guidance			
Excessive Noise				
41.	Exposure to noise			Ear plugs or muffs
Body and Leg Protection				
42.	Chemical exposure			Have local DMG H&S representative assist you in proper selection
43.	Using chainsaw, cutting brush			Chainsaw chaps

I certify that the above inspection was performed to the best of my knowledge and ability, based on the hazards present on _____.

Signature

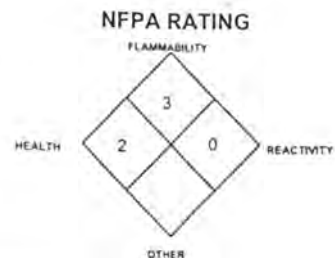
APPENDIX C

MSDSs for Constituents with Exposure Potential



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards



PART I *What is the material and what do I need to know in an emergency?*

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: **BENZENE - C₆H₆**
Document Number: 1062

PRODUCT USE: For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME: AIRGAS INC.
ADDRESS: 259 Radnor-Chester Road
Suite 100
Radnor, PA 19087-5240
1-610-687-5253

BUSINESS PHONE: CHEMTREC: 1-800-424-9300
EMERGENCY PHONE: International: 202-483-7616
May 14, 1997

DATE OF PREPARATION: May 14, 1997
SECOND REVISION: January 16, 1998

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH ppm	OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm		
BENZENE	71-43-2	99.9%	0.5, A1 (Confirmed Human Carcinogen)	2.5, A1 (Confirmed Human Carcinogen)	1	5	500	NIOSH REL: 0.1 ppm TWA; 1 ppm STEL OSHA: 1 ppm TWA; 5 ppm STEL OSHA Action Level: 0.5 ppm EPA-A; IARC-1; MAK-A1; NIOSH-X; NTP-1; OSHA- X;

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Benzene is a colorless, flammable, toxic liquid with a characteristic aromatic odor. Benzene is a confirmed human carcinogen and a possible human mutagen. Inhalation of vapors of Benzene can cause serious, permanent damage to the blood system. Skin and eye contact can be irritating. This liquid is very flammable; vapors are heavier than air and may travel long distances to source of ignition and flashback. If involved in a fire Benzene will decompose to produce toxic gases (e.g., carbon monoxide, carbon dioxide, irritating aldehydes and ketones). Persons responding to fires or emergencies involving Benzene must have adequate fire protection and wear personal protective equipment to protect against the significant health hazards posed by Benzene.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:

Benzene is a serious poison by all routes of exposure. The symptoms of each route of exposure are described below.

INHALATION: The immediate symptoms of inhalation of vapors of Benzene are due to the initial excitation, followed by depression of the central nervous system. Central nervous system symptoms include drowsiness, headache, nausea, incoordination and unconsciousness, that can lead to death in severe cases. Other symptoms of acute overexposure to vapors of Benzene can include transient euphoria, ataxia (incoordination of voluntary muscular movements), vertigo, tinnitus, substernal pain, cough, hoarseness and general irritation of the nose, throat and respiratory tract, confusion, stupefaction and coma. In cases of severe overexposure (as may occur in a confined space, or other poorly ventilated areas, or if large volumes are used or released), tremors, convulsions and death, due to respiratory paralysis or circulatory collapse can occur within minutes to several hours following exposure. Reversible liver and kidney effects have been reported after exposure to Benzene. The effects associated with various levels of Benzene vapors are as follows:

CONCENTRATION

Brief (10 minute) up to 25 ppm:
50-150 ppm:

20,000 (for 5-10 min):

SYMPTOM OF EXPOSURE

No symptoms.
Exhilaration, headache, tiredness,
nose and throat irritation.
Collapse and death



One of the most significant health effects associated with Benzene is the potential for blood system disorders which develop after long-term exposures to relatively low vapor concentrations. There are reports that exposure to low levels (10 ppm) over an extended time period (24 weeks) of Benzene vapors can damage the bone marrow and blood systems. This damage can result in the development of serious health disorders (including anemia and leukemia). Adverse effects on the immune system have also been reported. Refer to "Other Health Effects" in this section for further information.

CONTACT WITH SKIN or EYES: Contact with the skin can cause irritation and redness. Repeated or prolonged contact can also cause dermatitis, resulting in dry, itchy, cracked skin as Benzene is a defatting agent, removing oils from the skin. Contact with the vapors of Benzene and the eyes will be irritating. Direct contact of the liquid with the eyes can cause irritation, pain; prolonged contact may result in tissue damage.

SKIN ABSORPTION: Benzene poisoning through skin contact has been reported, although skin absorption is not considered as significant a route of exposure as via inhalation or ingestion. Symptoms of absorption may be similar to those described in "Ingestion".

INGESTION: Ingestion of Benzene will cause a burning sensation in the mouth and stomach, nausea, vomiting, excess salivation and vomiting of blood. Benzene is readily absorbed into the body following ingestion exposures, producing symptoms of central nervous system depression and other symptoms similar to those described in "Inhalation". If ingested, Benzene presents a potential aspiration hazard. Aspiration of even small amounts of Benzene into the lungs can result in immediate pulmonary edema (a potentially fatal accumulation of fluid in the lungs), chemical pneumonitis and hemorrhage of pulmonary tissue.

INJECTION: Injection is not anticipated to be a significant route of overexposure for Benzene. If Benzene is "injected" (as may occur through punctures by contaminated, sharp objects), symptoms described in "Inhalation" can occur.

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		FILED	2
FLAMMABILITY		FLAM	3
REACTIVITY		REACT	0
PROTECTIVE EQUIPMENT			X
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For routine industrial applications			

See Section 16 for Definition of Ratings

3. HAZARD IDENTIFICATION (Continued)

OTHER HEALTH EFFECTS: The chief target organ affected by serious Benzene exposure is the blood and bone marrow system. Chronic Benzene exposure eventually leads to pancytopenia (abnormal decrease of all three formed elements of the blood; hemoglobin, disease-fighting leukocytes and blood-clotting thrombocytes), followed by thrombocytopenia (problems with the blood-clotting properties of the blood) and anemia. These syndromes can lead to sudden, overwhelming infections. After exposure to Benzene, bleeding from the nose, gums, or mucous membranes and development of small bruises can occur. Benzene is a confirmed human carcinogen and can produce forms of leukemia. Direct contact with the liquid with mucous membranes will result in the development of hemorrhagic lesions.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure to may cause the health effects described on the following page.

ACUTE: Acute inhalation overexposure to Benzene will initially act as a narcotic, possibly leading to coma in extreme cases. Following exposure to high concentrations, victims may be unconscious, and if exposure continues, death can follow from respiratory failure and circulatory collapse. Contact with the skin can cause irritation and dermatitis. Contact with the eyes is irritating, causing burning and watering of the eyes. Ingestion of Benzene will cause gastric distress, hemorrhage and possible severe depression of the central nervous system. Aspiration of Benzene into the lungs, following ingestion, can result in severe damage to the lungs; death may result.

CHRONIC: Chronic exposure to Benzene causes serious damage to the health by all routes of exposure. Chronic oral and inhalation exposure causes severe effects on the blood system, including damage to the bone marrow, leading to a decrease in production or changes to the cells of hemoglobin, hematocrit, red and white blood cells. Effects can occur with an exposure level as low as 10 ppm for 24 weeks. Benzene also causes harmful changes to the immune system, decreasing the production of mature B- and T- white blood cells. Benzene is a confirmed human carcinogen, which can produce Hodgkin's Disease, leukemia and lymphomas by inhalation. Human mutation data are reported for Benzene. See Section 11 (Toxicological Information) for further information. Symptoms of chronic exposure by most routes can be delayed for months to years after exposure has ceased.

TARGET ORGANS: Respiratory system, central nervous system, blood and immune systems, bone marrow, heart, liver, kidneys, skin, eyes, and reproductive system.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO BENZENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. If necessary, a Self-Contained Breathing Apparatus should be worn.

INHALATION: If vapors, mists, or sprays of Benzene are inhaled, remove victim to fresh air. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Remove or cover gross contamination to avoid exposure to rescuers.

SKIN EXPOSURE: If Benzene contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek medical attention if any adverse reaction occurs.

EYE EXPOSURE: If Benzene or its vapors enter the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention.

INGESTION: If Benzene is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, do not induce vomiting. Victim should drink milk, egg whites, or large quantities of water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow.

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Physicians should refer to "Recommendations to Physicians" in Section 11 (Toxicological Information). Take copy of label and MSDS to health professional with victim.

5. FIRE-FIGHTING MEASURES

FLASH POINT, (Closed Cup): -11°C (12°F)

AUTOIGNITION TEMPERATURE: 498°C (928°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 1.3%

Upper (UEL): 7.1%

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES (for cooling only)

Foam: YES

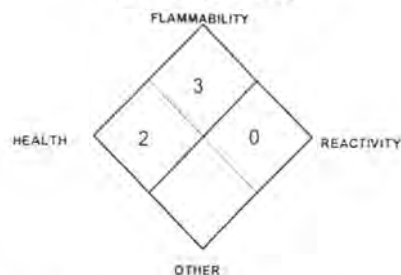
Halon: YES

Carbon Dioxide: YES

Dry Chemical: YES

Other: Any "B" Class

NFPA RATING



UNUSUAL FIRE AND EXPLOSION HAZARDS: Benzene is a Class IB flammable liquid and presents a serious fire hazard to firefighters. Due to the low flash point, vapors can form explosive mixtures with air, at room temperature. When involved in a fire, this material may decompose and produce toxic gases (e.g., carbon monoxide, carbon dioxide, irritating aldehydes and ketones). The vapors of Benzene are heavier than air and may spread long distances; distant ignition and flash-back are possible. Benzene can float on water; therefore, water contaminated with Benzene can spread the flammable liquid and can spread fire. Containers of Benzene, when involved in fire, may rupture or burst in the heat of the fire.

See Section 16 for Definition of Ratings

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Benzene can accumulate static charge by flow or agitation; vapors can be ignited by static discharge.

SPECIAL FIRE-FIGHTING PROCEDURES: In the event of fire, cool containers of Benzene with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Water may not be effective in actually extinguishing a fire involving Benzene, due to its low flash point. Stop the leak or discharge, if possible. For small releases, if it is not possible to stop the leak, and it does not endanger personnel, let the fire burn itself out. Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment, including chemical resistant clothing. Large fires should be fought from a distance with an unmanned hose holder or monitor nozzles. If Benzene is involved in a fire, fire runoff water should be contained to prevent possible environmental damage. If necessary, decontaminate fire-response equipment with soap and water solution. For large releases, consider evacuation. Refer to the North American Emergency Response Guidebook (Guide #130) for additional guidance.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel.

Minimum Personal Protective Equipment should be **Level B: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), chemical resistant suit and boots, hard-hat, and Self-Contained Breathing Apparatus**. Monitor the surrounding area for combustible vapor levels. Combustible vapor levels must be below 10% of the LEL for Benzene (LEL = 1.3%) before personnel are permitted to enter the area. If necessary, ventilate area.

Monitoring should be done for the levels of Benzene and oxygen. Colorimetric tubes are available to detect the presence of Benzene. Levels of Benzene should be below levels listed in Section 2 (Composition and Information on Ingredients) and the atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

Eliminate all sources of ignition before clean-up operations begin. Use non-sparking tools. Absorb spilled liquid with activated carbon, polypads or other suitable absorbent materials. Prevent material from entering sewer or confined spaces. Decontaminate the area thoroughly. Place all spill residue in an appropriate container and seal. If necessary, decontaminate spill-response equipment with soap and water solution. Dispose of in accordance with Federal, State, and local hazardous waste disposal regulations (see Section 13, Disposal Considerations).

THIS IS AN EXTREMELY FLAMMABLE, TOXIC LIQUID: Protection of all personnel and the area must be maintained. All responders must be adequately protected from exposure.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Benzene ON YOU or IN YOU. Wash hands after handling chemicals. Do not eat or drink while handling this material. Remove contaminated clothing immediately.

Note: Refer to the OSHA Benzene Standard (29 CFR 1910.1028) for specific requirements associated with the use of Benzene. The Action Level for Benzene is 0.5 ppm as an 8-hour, time-weighted average. In workplaces where employees are exposed above the Action Level, the OSHA requirements for monitoring, establishment of regulated areas, methods of compliance, respiratory protection, emergency response protocol, medical surveillance, training and record keeping must be followed.

STORAGE AND HANDLING PRACTICES: Entrances to regulated areas (as defined by the OSHA Benzene Standard) must be posted with signs which reads as follows:

<p style="text-align: center;">DANGER BENZENE CANCER HAZARD FLAMMABLE- NO SMOKING AUTHORIZED PERSONNEL ONLY</p>
--

All employees who handle this material should be trained to handle it safely. Avoid breathing vapors or mists generated by Benzene. Use in a well-ventilated location. Cylinders of Benzene must be properly labeled. If Benzene is used in other types of containers, only use portable containers and dispensing equipment (faucet, pump, drip can) approved for flammable liquids.

Store cylinders of Benzene in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Do not allow area where cylinders are stored to exceed 52°C (125°F). Material should be stored in secondary containers, or in a diked area, as appropriate. Store containers away from incompatible chemicals. Keep container tightly closed when not in use. Storage areas should be made of fire-resistant materials. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Refer to NFPA 30, Flammable and Combustible Liquids Code, for additional information on storage.

Empty containers may contain residual flammable liquid or vapors. Therefore, empty containers should be handled with care. Do not expose "empty" containers to welding touches, or any other source of ignition.

SPECIAL PRECAUTIONS FOR HANDLING CYLINDERS: Protect cylinders of Benzene against physical damage. If appropriate, cylinders should be stored in an up-right position. Cylinders should be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used:

Before Use: If appropriate, move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with Benzene. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Bulletin SB-2 "Oxygen Deficient Atmospheres".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use Benzene in areas where adequate ventilation is provided. Decontaminate equipment using soapy water before maintenance begins. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Use a mechanical fan or vent area to outside. Where appropriate, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Ensure eyewash/safety shower stations are available near areas where Benzene is used.

RESPIRATORY PROTECTION: Maintain exposure levels of Benzene below the levels listed in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if Benzene levels exceed exposure limits and if oxygen level is below 19.5% or during emergency response to a release of Benzene. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards. The following NIOSH respiratory protection recommendations are for Benzene.

CONCENTRATION

RESPIRATORY EQUIPMENT

At Concentrations Above the NIOSH REL, or Where there is no REL, at any Detectable Concentration: Positive-pressure, full facepiece SCBA or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

Escape: Gas mask with organic vapor cartridge or escape-type SCBA should be used.

The IDLH concentration for Benzene is 500 ppm. The carcinogenic effects of Benzene were not considered by NIOSH in determination of the IDLH.

NOTE: In areas which exceed the OSHA Action Level of Benzene, the respirator selection guidelines in the Benzene Standard [29 CFR 1910.1028 (g)] apply.

EYE PROTECTION: Splash goggles or safety glasses. Face-shields should be worn if contact with the liquid is anticipated.

HAND PROTECTION: Wear leather gloves for handling of cylinders of Benzene. Wear chemically impervious gloves appropriate for Benzene for industrial use. Gloves should have a resistance to breakthrough greater than 8 hours, such as polyvinyl alcohol, Barricade™ or Responder™. **Butyl rubber, natural rubber, neoprene, nitrile rubber, or polyethylene, polyvinyl chloride, Saranex™, Chemrel™ are not recommended.** Use triple gloves for spill response (see Section 6, Accidental Release Measures).

BODY PROTECTION: Use body protection appropriate for task. An impervious, full-body, encapsulating suit may be necessary for some operations involving Benzene. Safety shoes are recommended when handling cylinders.

9. PHYSICAL and CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): 2.7

SPECIFIC GRAVITY(@ 68°F (20°C) (water = 1): 0.877

SOLUBILITY IN WATER @ 77°F (25°C): 180 mg/mL

EVAPORATION RATE (diethyl ether = 1): 2.8

ODOR THRESHOLD: 97 ppm(detection); 97 ppm (recognition)

LOG COEFFICIENT WATER/OIL DISTRIBUTION: Log P (oct) = 1.18-1.9; 2.13; 2.15

VAPOR PRESSURE @ 68°F (20°C): 75 mm Hg; 10 kPa

pH: Not applicable.

FREEZING/MELTING POINT: 5.5°C (42°F)

BOILING POINT: 80°C (176°F)

SPECIFIC VOLUME: Not applicable.

EXPANSION RATIO: Not applicable.

APPEARANCE AND COLOR: Colorless, flammable liquid, with a characteristic aromatic hydrocarbon odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor of Benzene is not a good warning property as the odor threshold is above the TLV.

10. STABILITY and REACTIVITY

STABILITY: Normally stable.

DECOMPOSITION PRODUCTS: If Benzene is involved in a fire, it may ignite to yield toxic fumes of carbon monoxide, carbon dioxide, irritating aldehydes and ketones.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Benzene becomes spontaneously flammable in the presence of sodium peroxide and potassium peroxide. Benzene can explode on contact with chromic anhydride, permanganic acid and chlorine.

10. STABILITY and REACTIVITY (Continued)

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE (Continued): Benzene can react vigorously with oxidizing materials. Benzene may react violently or explosively with risk of fire with nitric acid, ozone, diborane, interhalogens (e.g., bromine trifluoride, bromine pentafluoride, chloride trifluoride, iodine pentafluoride, iodine heptafluoride), dioxygen difluoride, dioxygenyl tetrafluoroborate, permanganic acid, peroxodisulfuric acid, peroxomonosulfuric acid. Benzene will react with nitryl perchlorate, causing a slight explosion and flash. Benzene will react vigorously with uranium hexafluoride. Benzene will attack rubber and plastics.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid contact with incompatible materials, sparks, flame static discharge and other sources of ignition. Avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture or burst.

PART III *How can I prevent hazardous situations from occurring?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is available for Benzene.

Skin-Rabbit, adult 15 mg/24 hours open Mild irritation effects
Skin-Rabbit, adult 20 mg/24 hours Moderate irritation effects
Eye effects-Rabbit, adult 88 mg Moderate irritation effects
Eye effects-Rabbit, adult 2 mg/24H Severe irritation effects
ons-Human: lymphocyte 5 μ mol/L
Microsomal Mutagenicity Assay-Mouse: embryo 2500 mg/L
Oral-Mouse TDLo: 6500 mg/kg (female 8-12 days post): Reproductive effects Teratogenesis, Carcinogenesis, and Mutagenesis
Inhalation-Mouse TCLo: 5 ppm (female 6-15 days post) Teratogenic effects
Inhalation-Man TCLo: 200 mg/m³/78 weeks -intermittent; Carcinogenic effects, Blood effects
Inhalation-Human TCLo: 10 ppm/8 hours /10 years-intermittent; Carcinogenic effects, Blood effects
Oral-Rat TDLo: 52 g/kg/52 weeks - intermittent; Carcinogenic effects
Inhalation-Rat TCLo: 1200 ppm/6 hours/10 weeks - intermittent; Equivocal tumorigenic agent
Oral-Mouse TDLo: 18,250 mg/kg/2 years - continuous; Carcinogenic effects
Inhalation-Human TC: .8 ppb/4 weeks- intermittent; Carcinogenic effects, Blood effects
Inhalation-Dog, adult LCLo: 146,000 mg/
Inhalation-Cat, adult LCLo: 170,000 mg/m³
Inhalation-Human TC: 10 mg/m³/11 years- intermittent; Carcinogenic effects, Blood effects
Inhalation-Mouse TCLo: 300 ppm/6 hours/16 weeks-intermittent; Equivocal tumorigenic agent
Skin-Mouse TDLo: 1200 g/kg/49 weeks - intermittent; Neoplastic effects
Intraperitoneal-Mouse TDLo: 1200 mg/kg/8 weeks - intermittent; Neoplastic effects

Inhalation-Man TC: 150 ppm/11 years - intermittent; Carcinogenic effects, Blood effects
Inhalation-Mouse TC: 1200 ppm/6 hours/10 weeks - intermittent; Equivocal tumorigenic agent
Oral-Mouse TD: 2400 mg/kg/8 weeks -intermittent; Neoplastic effects
Inhalation-Mouse TC: 300 ppm/6 hours/16 weeks intermittent; Carcinogenic effects
Inhalation-Human LCLo: 2 pph/5 minutes
Oral-Man LDLo: 50 mg/kg
Inhalation-Human LCLo: 20,000 ppm/5
Inhalation-Man TCLo: 150 ppm/1 year - intermittent; Blood effects
Inhalation-Human TCLo: 100 ppm
Intravenous-Rabbit adult LDLo: 88 mg/kg
Inhalation-Human LCLo: 65 mg/m³/5 years; Blood effects
Oral-Rat LD50: 3306 mg/kg
Inhalation-Rat LC50: 10,000 ppm/7 hours
Intraperitoneal-Rat LD50: 2890 μ g/kg
Oral-Mouse LD50: 4700 mg/kg
Inhalation-Mouse LC50: 9980 ppm
Intraperitoneal-Mouse LD50: 340 mg/kg
Oral-Dog, adult LDLo: 2000 mg/kg
Subcutaneous-Mouse TDLo: 600 mg/kg/17 weeks - intermittent; Equivocal tumorigenic agent
Parenteral-Mouse TDLo: 670 mg/kg/19 weeks - intermittent; Equivocal tumorigenic agent
Inhalation-Human TC: 150 ppm/15 minutes /8 years - intermittent; Carcinogenic effects, Blood effects
Oral-Rat TD: 52 g/kg/1 years - intermittent; Carcinogenic effects
Oral-Rat TD: 10 g/kg/52 weeks - intermittent; Carcinogenic effects
Inhalation-Man TC: 600 mg/m³/4 years - intermittent; Carcinogenic effects, Blood effects

Additional Information on Benzene: Because of the chronic toxicity effects associated with Benzene, additional information is provided, as follows:

EFFECTS ON THE BLOOD AND BLOOD-FORMING ORGANS: Extensive studies have conclusively proven that oral and inhalation exposure to benzene causes severe effects on the blood system, including damaging the bone marrow where new blood cells are formed. Most studies report a decrease in hemoglobin, hematocrit, red and white blood cells, platelets and/or changes in the cells. Effects of varying severity have been demonstrated with both intermittent and continuous exposures to concentrations as low as 10 ppm for 24 weeks.

EFFECTS ON THE IMMUNE SYSTEM: Studies have also conclusively shown that benzene causes harmful changes to the immune system which protects the body from disease. Benzene has decreased the number of mature B- and T-lymphocytes (white blood cells which produce disease-fighting antibodies). Exposure of mice to 300 ppm for 6 to 23 weeks resulted in a decrease in the number of mature B- and T-lymphocytes. Rats and mice exposed orally to 25 to 200 mg/kg/day for 2 years had significantly reduced white blood cells and lymphocytes.

11. TOXICOLOGICAL INFORMATION (Continued)

SUSPECTED CANCER AGENT: Benzene is listed as follows:

BENZENE: ACGIH-A2 (Suspected Human Carcinogen); EPA-A (Human Carcinogen); IARC-1 (Carcinogenic to Humans); MAK-A1 (Capable of Inducing Malignant Tumors/Experience with Humans); NIOSH-X (Carcinogen); NTP-1 (Known to be a Carcinogen); OSHA-X (Carcinogen); Cal-OSHA (Carcinogen).

IRRITANCY OF PRODUCT: Benzene is irritating to the skin, eyes, and other contaminated tissue.

SENSITIZATION OF PRODUCT: Benzene is not known to cause respiratory system or skin sensitization in humans. Cardiac sensitization to stimulants (e.g., epinephrine, ephedrine) is a possible result of severe or chronic overexposure.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Benzene on the human reproductive system.

Mutagenicity: Human mutation data are available for Benzene. These data were obtained from individuals who were exposed at levels which produced changes in the blood system.

Embryotoxicity: Benzene is not reported to cause embryotoxic effects in humans.

Teratogenicity: Benzene is not reported to cause teratogenic effects in humans. Teratogenic data are available from clinical studies involving test animals exposed to relatively high doses of Benzene. Fetotoxic effects (e.g., reduced birth weight and/or minor skeletal variations) were observed at exposures above 50 ppm.

Reproductive Toxicity: Data on reproductive effects on ovaries and testes are available from clinical studies involving test animals exposed to relatively high doses of Benzene. These data were obtained at doses which caused toxic effects on other organs.

*A **mutagen** is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An **embryotoxin** is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance which interferes in any way with the reproductive process.*

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing blood system disorders, respiratory conditions, central nervous, liver, kidney, and cardio-vascular conditions may be aggravated by severe or chronic overexposure to Benzene. Skin disorders may also be aggravated by exposures to Benzene.

RECOMMENDATIONS TO PHYSICIANS: The following guidelines are derived from "Clinical Toxicology of Commercial Chemical Products" (5th edition, 1984).

- Check for signs of impending pulmonary edema.
- Because of the aspiration hazard, avoid emetic drugs, whenever practical.
- For overexposures in which emesis is advisable: If the patient is not drowsy, comatose, or in respiratory difficulty, induce vomiting. If necessary, as an alternative treatment, remove Benzene from the stomach via gastric lavage. One or two ounces of mineral oil may be instilled and left in the stomach at the completion of lavage.
- Avoid epinephrine because of its possible adverse effect on the sensitized myocardium. Avoid all digestible fats, oils and alcohol, which may promote the absorption of Benzene in the intestinal system.
- If eyes or skin are affected, wash thoroughly and apply a bland analgesic ointment.
- Because of the possibility of ventricular fibrillation, monitor the ECG continuously and be prepared to administer external cardiac massage.

Refer to the OSHA Benzene Standard [29 CFR 1910.1028; paragraph(i) and Appendix C] for specific information on Medical Surveillance requirements (i.e. for the general physical exam, medical history, specific tests, and re-examination protocol).

BIOLOGICAL EXPOSURE INDICES (BEIs): The following Biological Exposure Indices (BEIs) are currently applicable for Benzene.

BIOLOGICAL EXPOSURE INDICES (BEIs) for Benzene are as follows:		
CHEMICAL DETERMINANT	SAMPLING TIME	BEI
BENZENE <ul style="list-style-type: none">• Total phenol in urine• Benzene in exhaled air:<ul style="list-style-type: none">mixed-exhaledend-exhaled	<ul style="list-style-type: none">• End of shift• Prior to next shift	<ul style="list-style-type: none">• 50 mg/g creatinine• 0.08 ppm• 0.12 ppm

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Benzene will be degraded over time into other organic compounds. The following environmental data are available for Benzene.

BENZENE: $K_{OW} = 2.13$. Water Solubility = 1791 mg/L. BCF (*Anguilla japonica*, eels) = 3.5. BCF (*Clupea harengus* Pallas, pacific herring) = 4.4. BCF (goldfish) = 4.3. BCF, benzene = 24 (estimated). If benzene is released into the soil, it will be volatilized near the surface or it will leach to the groundwater. No degradation of benzene (BOD) was reported in coarse-filtered Lake Superior harbor water incubated at 21°C for 12 days. In the marine eco-system, biodegradation occurs from 2 days to 2 weeks in the summer and spring, respectively. The half-life of Benzene in estuarine water was 5 days, as measured by $^{14}CO_2$ produced. Biodegradation half-lives of 28 and 16 days were reported in die-away tests for degradation of up to 3.2 UL/L benzene using groundwater and Lester River water, respectively, under aerobic conditions. In a base-rich para-brownish soil, 20 ppm benzene was 24% degraded in one week, 44% in 5 weeks and 47% in 10 weeks. It is not expected to adsorb to sediment nor bioconcentrate in aquatic organisms.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Benzene may be harmful or fatal to contaminated plant and animal-life (especially if large quantities of Benzene are released). Refer to Section 11 (Toxicology Information). Additional information is available on the effects of Benzene on plants as follows:

Benzene is lethal to plants at high concentrations (GT 15600 ppm in air) and short (30 minutes) exposure times. In all species studied recovery was complete upon removal from exposure to sub-lethal concentrations.

Plant growth and rooting is stimulated by aqueous solutions of low benzene concentrations (0.01-0.10 saturated). Aqueous solutions containing high concentrations (0.10-0.15% Benzene) inhibit growth and interfere with metabolism and cell division.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Benzene can be harmful or fatal to contaminated aquatic plant and animal life. Benzene floats on water, and can potentially form slicks which are capable of creating oxygen-deprived waterways which can contaminate coastal and shore life. The following aquatic toxicity data are available for Benzene.

LC₁₀₀ (*Tetrahymena pyriformis*, ciliate) = 12.8 mmol/L/24 hours
LC₅₀ (*Palaemonetes pugio*, grass shrimp) = 27 ppm/96 hours
LC₅₀ (*Cancer magister*, crab larvae, stage 1) = 108 ppm/96 hours
LC₅₀ (*Crangon franciscorum*, shrimp) = 20 ppm/96 hours
LC₅₀ (*Poecilia reticulata*, guppy) = 63 ppm/14 days
LC₅₀ (*Morone saxatilis*, bass) = 5.8 to 10.9 ppm/96 hours
LC₅₀ (*Salmo trutta*, brown trout yearling) = 12 mg/L/1-hour
LC₅₀ (*Ambystoma mexicana*, mexican axotl salamander, 3-4 weeks after hatching) = 370 mg/L/48 hours
LC₅₀ (clawed toad, 3-4 weeks after hatching) = 190 mg/L/48 hours
LD₅₀ (*Carassius auratus*, goldfish) = 46 mg/L/24-hours
LD₅₀ (*Lepomis macrochirus*, bluegill sunfish) = 60 mg/L/2-hours

LC (*Daphnia magna*) highest no adverse level = 98 mg/L
Effect level (blue crab) = 1 mg/L
EC₅₀ (freshwater green algae, *Ankistrodesmus falcatus*) = 310 mg (3.97 mmol/L)
Photosynthetic carbon fixation (*Selenastrum capricornutum*) = 100, 95, 84, 5, for 24 hour exposure to 0, 10, 100 or 1000 mg Benzene/L
Growth inhibition (*Chlorella vulgaris*) = significant for 25-1744 ppm Benzene
Light saturated photosynthesis relative rates (*Nitzschia palea*, freshwater diatom) = 100, 61, 38, 13; exposure for 2 hours to 0, 175, 350, 520 mg Benzene/L
Growth inhibition (*Skeletonema costatum*) = at 20 mg/L

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with residual product to Airgas Inc. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Benzene
HAZARD CLASS NUMBER and DESCRIPTION:	3 (Flammable Liquid)
UN IDENTIFICATION NUMBER:	UN 1114
PACKING GROUP:	PG II
DOT LABEL(S) REQUIRED:	Flammable Liquid
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):	130

MARINE POLLUTANT: Benzene is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments. Also, there is an additional Hazard Class: 9.2 (Substance Hazardous to the Environment).

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Benzene is subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act., as follows:

COMPONENT	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Benzene	NO	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITIES (RQ): 10 lb; RCRA Code = U019.

CANADIAN DSL/NDL INVENTORY STATUS: Benzene is on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Benzene is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Benzene is subject to the requirements of CFR 29 1910.1028, the OSHA Benzene Standard. The Action Level for Benzene is 0.5 ppm as an 8-hour, time-weighted average under this regulation. The EPA is promulgating water regulations for certain volatile organic chemicals. Specifically, this notice promulgates a maximum contaminant level for Benzene at 0.005 mg/L. Benzene is not listed in Appendix A as a highly hazardous chemical, per 29 CFR 1910.119: Process Safety Management of Highly Hazardous Chemicals. Under this regulation, however, any process that involves a flammable liquid on-site, in one location, in quantities of 10,000 lbs (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Benzene is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Benzene.	Minnesota - List of Hazardous Substances: Benzene.	Pennsylvania - Hazardous Substance List: Benzene.
California - Permissible Exposure Limits for Chemical Contaminants: Benzene.	Missouri - Employer Information/Toxic Substance List: Benzene.	Rhode Island - Hazardous Substance List: Benzene.
Florida - Substance List: Benzene.	New Jersey - Right to Know Hazardous Substance List: Benzene.	Texas - Hazardous Substance List: Benzene.
Illinois - Toxic Substance List: Benzene.	North Dakota - List of Hazardous Chemicals, Reportable Quantities: Benzene.	West Virginia - Hazardous Substance List: Benzene.
Kansas - Section 302/313 List: Benzene.		Wisconsin - Toxic and Hazardous Substances: Benzene.
Massachusetts - Substance List: Benzene.		
Michigan Critical Materials Register: Benzene.		

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Benzene is listed on the California Proposition 65 Lists. **WARNING:** Benzene is known to the State of California to cause cancer.

LABELING: DANGER! EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR CAN CAUSE FLASH FIRE. FLASH POINT = -11°C (12°F). HARMFUL IF INHALED. HARMFUL OR FATAL IF SWALLOWED. PROLONGED OR REPEATED SKIN CONTACT MAY DRY SKIN AND CAUSE IRRITATION. CAN CAUSE CENTRAL NERVOUS SYSTEM EFFECTS. CHRONIC EXPOSURE MAY CAUSE LEUKEMIA AND CAN CAUSE ADVERSE EFFECTS ON THE BLOOD SYSTEM, LIVER, KIDNEYS, REPRODUCTIVE SYSTEM. CAN CAUSE DEATH IF TOO MUCH IS BREATHED. ASPIRATION HAZARD IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation. Avoid contact with skin and clothing. Avoid exposure to vapor. Wash thoroughly after handling. **FIRST-AID:** In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if irritation develops or persists. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of fire, use water fog, foam, dry chemical, or CO₂. In case of spill: Absorb spill with inert materials (e.g. activated carbon, dry sand). Flush residual spill with water. Consult Material Safety Data Sheet for additional information.

CANADIAN WHMIS SYMBOLS: **Class B2:** Flammable Liquid.

Class D2A/D2B: Material Causing Other Toxic Effects



16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS # - This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (TWA), the 15-minute Short Term Exposure Limit, and the Instantaneous Ceiling Level (C). Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL.

NIOSH is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (OSHA). NIOSH issues exposure guidelines called Recommended Exposure Levels (RELs). When no exposure guidelines are established, an entry of NE is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard:

0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: 0 (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); 2 (materials that are unstable but do not detonate or which can react violently with water); 3 (materials that can detonate when initiated or which can react explosively with water); 4 (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure could cause serious temporary or residual injury); 4 (materials that under very short exposure causes death or major residual injury).

NATIONAL FIRE PROTECTION ASSOCIATION (Continued):

Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (NFPA). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** - concentration expressed in parts of material per million parts of air or water; **mg/m³** - concentration expressed in weight of substance per volume of air; **mg/kg** - quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program; **RTECS** - the Registry of Toxic Effects of Chemical Substances; **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo**, the lowest concentration to cause a symptom; **TD₀**, **LDLo**, and **LD₀**, or **TC**, **TC₀**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: **EC** is the effect concentration in water.

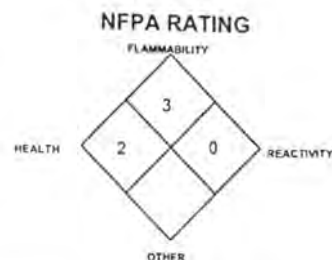
REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (SARA); the Canadian Domestic/Non-Domestic Substances List (DSL/NDL); the U.S. Toxic Substances Control Act (TSCA); Marine Pollutant status according to the DOT; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund); and various state regulations.



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards



PART I What is the material and what do I need to know in an emergency?

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

BENZENE - C₆H₆

Document Number: 1062

PRODUCT USE:

For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME:

AIRGAS INC.

ADDRESS:

259 Radnor-Chester Road

Suite 100

Radnor, PA 19087-5240

1-610-687-5253

BUSINESS PHONE:

CHEMTREC: 1-800-424-9300

EMERGENCY PHONE:

International: 202-483-7616

DATE OF PREPARATION:

May 14, 1997

SECOND REVISION:

January 16, 1998

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH ppm	OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm		
BENZENE	71-43-2	99.9%	0.5, A1 (Confirmed Human Carcinogen)	2.5, A1 (Confirmed Human Carcinogen)	1	5	500	NIOSH REL: 0.1 ppm TWA; 1 ppm STEL OSHA: 1 ppm TWA; 5 ppm STEL OSHA Action Level: 0.5 ppm EPA-A; IARC-1; MAK-A1; NIOSH-X; NTP-1; OSHA- X;

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Benzene is a colorless, flammable, toxic liquid with a characteristic aromatic odor. Benzene is a confirmed human carcinogen and a possible human mutagen. Inhalation of vapors of Benzene can cause serious, permanent damage to the blood system. Skin and eye contact can be irritating. This liquid is very flammable; vapors are heavier than air and may travel long distances to source of ignition and flashback. If involved in a fire Benzene will decompose to produce toxic gases (e.g., carbon monoxide, carbon dioxide, irritating aldehydes and ketones). Persons responding to fires or emergencies involving Benzene must have adequate fire protection and wear personal protective equipment to protect against the significant health hazards posed by Benzene.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE: Benzene is a serious poison by all routes of exposure. The symptoms of each route of exposure are described below.

INHALATION: The immediate symptoms of inhalation of vapors of Benzene are due to the initial excitation, followed by depression of the central nervous system. Central nervous system symptoms include drowsiness, headache, nausea, incoordination and unconsciousness, that can lead to death in severe cases. Other symptoms of acute overexposure to vapors of Benzene can include transient euphoria, ataxia (incoordination of voluntary muscular movements), vertigo, tinnitus, substernal pain, cough, hoarseness and general irritation of the nose, throat and respiratory tract, confusion, stupefaction and coma. In cases of severe overexposure (as may occur in a confined space, or other poorly ventilated areas, or if large volumes are used or released), tremors, convulsions and death, due to respiratory paralysis or circulatory collapse can occur within minutes to several hours following exposure. Reversible liver and kidney effects have been reported after exposure to Benzene. The effects associated with various levels of Benzene vapors are as follows:

CONCENTRATION

Brief (10 minute) up to 25 ppm:
50-150 ppm:

20,000 (for 5-10 min):

SYMPTOM OF EXPOSURE

No symptoms.
Exhilaration, headache, tiredness,
nose and throat irritation.
Collapse and death



One of the most significant health effects associated with Benzene is the potential for blood system disorders which develop after long-term exposures to relatively low vapor concentrations. There are reports that exposure to low levels (10 ppm) over an extended time period (24 weeks) of Benzene vapors can damage the bone marrow and blood systems. This damage can result in the development of serious health disorders (including anemia and leukemia). Adverse effects on the immune system have also been reported. Refer to "Other Health Effects" in this section for further information.

CONTACT WITH SKIN or EYES: Contact with the skin can cause irritation and redness. Repeated or prolonged contact can also cause dermatitis, resulting in dry, itchy, cracked skin as Benzene is a defatting agent, removing oils from the skin. Contact with the vapors of Benzene and the eyes will be irritating. Direct contact of the liquid with the eyes can cause irritation, pain; prolonged contact may result in tissue damage.

SKIN ABSORPTION: Benzene poisoning through skin contact has been reported, although skin absorption is not considered as significant a route of exposure as via inhalation or ingestion. Symptoms of absorption may be similar to those described in "Ingestion".

INGESTION: Ingestion of Benzene will cause a burning sensation in the mouth and stomach, nausea, vomiting, excess salivation and vomiting of blood. Benzene is readily absorbed into the body following ingestion exposures, producing symptoms of central nervous system depression and other symptoms similar to those described in "Inhalation". If ingested, Benzene presents a potential aspiration hazard. Aspiration of even small amounts of Benzene into the lungs can result in immediate pulmonary edema (a potentially fatal accumulation of fluid in the lungs), chemical pneumonitis and hemorrhage of pulmonary tissue.

INJECTION: Injection is not anticipated to be a significant route of overexposure for Benzene. If Benzene is "injected" (as may occur through punctures by contaminated, sharp objects), symptoms described in "Inhalation" can occur.

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		ELI	2
FLAMMABILITY		FL	3
REACTIVITY		AD	0
PROTECTIVE EQUIPMENT		X	
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For routine industrial applications			

See Section 16 for Definition of Ratings

3. HAZARD IDENTIFICATION (Continued)

OTHER HEALTH EFFECTS: The chief target organ affected by serious Benzene exposure is the blood and bone marrow system. Chronic Benzene exposure eventually leads to pancytopenia (abnormal decrease of all three formed elements of the blood; hemoglobin, disease-fighting leukocytes and blood-clotting thrombocytes), followed by thrombocytopenia (problems with the blood-clotting properties of the blood) and anemia. These syndromes can lead to sudden, overwhelming infections. After exposure to Benzene, bleeding from the nose, gums, or mucous membranes and development of small bruises can occur. Benzene is a confirmed human carcinogen and can produce forms of leukemia. Direct contact with the liquid with mucous membranes will result in the development of hemorrhagic lesions.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure to may cause the health effects described on the following page.

ACUTE: Acute inhalation overexposure to Benzene will initially act as a narcotic, possibly leading to coma in extreme cases. Following exposure to high concentrations, victims may be unconscious, and if exposure continues, death can follow from respiratory failure and circulatory collapse. Contact with the skin can cause irritation and dermatitis. Contact with the eyes is irritating, causing burning and watering of the eyes. Ingestion of Benzene will cause gastric distress, hemorrhage and possible severe depression of the central nervous system. Aspiration of Benzene into the lungs, following ingestion, can result in severe damage to the lungs; death may result.

CHRONIC: Chronic exposure to Benzene causes serious damage to the health by all routes of exposure. Chronic oral and inhalation exposure causes severe effects on the blood system, including damage to the bone marrow, leading to a decrease in production or changes to the cells of hemoglobin, hematocrit, red and white blood cells. Effects can occur with an exposure level as low as 10 ppm for 24 weeks. Benzene also causes harmful changes to the immune system, decreasing the production of mature B- and T- white blood cells. Benzene is a confirmed human carcinogen, which can produce Hodgkin's Disease, leukemia and lymphomas by inhalation. Human mutation data are reported for Benzene. See Section 11 (Toxicological Information) for further information. Symptoms of chronic exposure by most routes can be delayed for months to years after exposure has ceased.

TARGET ORGANS: Respiratory system, central nervous system, blood and immune systems, bone marrow, heart, liver, kidneys, skin, eyes, and reproductive system.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO BENZENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. If necessary, a Self-Contained Breathing Apparatus should be worn.

INHALATION: If vapors, mists, or sprays of Benzene are inhaled, remove victim to fresh air. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Remove or cover gross contamination to avoid exposure to rescuers.

SKIN EXPOSURE: If Benzene contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek medical attention if any adverse reaction occurs.

EYE EXPOSURE: If Benzene or its vapors enter the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention.

INGESTION: If Benzene is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, do not induce vomiting. Victim should drink milk, egg whites, or large quantities of water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow.

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Physicians should refer to "Recommendations to Physicians" in Section 11 (Toxicological Information). Take copy of label and MSDS to health professional with victim.

5. FIRE-FIGHTING MEASURES

FLASH POINT, (Closed Cup): -11°C (12°F)

AUTOIGNITION TEMPERATURE: 498°C (928°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 1.3%

Upper (UEL): 7.1%

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES (for cooling only)

Foam: YES

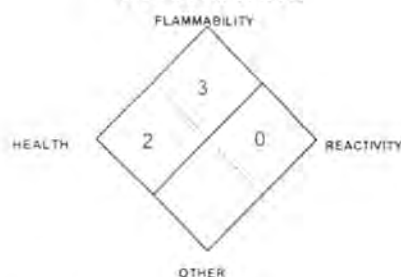
Halon: YES

Carbon Dioxide: YES

Dry Chemical: YES

Other: Any "B" Class.

NFPA RATING



UNUSUAL FIRE AND EXPLOSION HAZARDS: Benzene is a Class IB flammable liquid and presents a serious fire hazard to firefighters. Due to the low flash point, vapors can form explosive mixtures with air, at room temperature. When involved in a fire, this material may decompose and produce toxic gases (e.g., carbon monoxide, carbon dioxide, irritating aldehydes and ketones). The vapors of Benzene are heavier than air and may spread long distances; distant ignition and flash-back are possible. Benzene can float on water; therefore, water contaminated with Benzene can spread the flammable liquid and can spread fire. Containers of Benzene, when involved in fire, may rupture or burst in the heat of the fire.

See Section 16 for Definition of Ratings

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Benzene can accumulate static charge by flow or agitation; vapors can be ignited by static discharge.

SPECIAL FIRE-FIGHTING PROCEDURES: In the event of fire, cool containers of Benzene with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Water may not be effective in actually extinguishing a fire involving Benzene, due to its low flash point. Stop the leak or discharge, if possible. For small releases, if it is not possible to stop the leak, and it does not endanger personnel, let the fire burn itself out. Incipient fire responders should wear eye protection. Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment, including chemical resistant clothing. Large fires should be fought from a distance with an unmanned hose holder or monitor nozzles. If Benzene is involved in a fire, fire runoff water should be contained to prevent possible environmental damage. If necessary, decontaminate fire-response equipment with soap and water solution. For large releases, consider evacuation. Refer to the North American Emergency Response Guidebook (Guide #130) for additional guidance.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel.

Minimum Personal Protective Equipment should be **Level B: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), chemical resistant suit and boots, hard-hat, and Self-Contained Breathing Apparatus.** Monitor the surrounding area for combustible vapor levels. Combustible vapor levels must be below 10% of the LEL for Benzene (LEL = 1.3%) before personnel are permitted to enter the area. If necessary, ventilate area.

Monitoring should be done for the levels of Benzene and oxygen. Colorimetric tubes are available to detect the presence of Benzene. Levels of Benzene should be below levels listed in Section 2 (Composition and Information on Ingredients) and the atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

Eliminate all sources of ignition before clean-up operations begin. Use non-sparking tools. Absorb spilled liquid with activated carbon, polypads or other suitable absorbent materials. Prevent material from entering sewer or confined spaces. Decontaminate the area thoroughly. Place all spill residue in an appropriate container and seal. If necessary, decontaminate spill-response equipment with soap and water solution. Dispose of in accordance with Federal, State, and local hazardous waste disposal regulations (see Section 13, Disposal Considerations).

THIS IS AN EXTREMELY FLAMMABLE, TOXIC LIQUID: Protection of all personnel and the area must be maintained. All responders must be adequately protected from exposure.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Benzene ON YOU or IN YOU. Wash hands after handling chemicals. Do not eat or drink while handling this material. Remove contaminated clothing immediately.

Note: Refer to the OSHA Benzene Standard (29 CFR 1910.1028) for specific requirements associated with the use of Benzene. The Action Level for Benzene is 0.5 ppm as an 8-hour, time-weighted average. In workplaces where employees are exposed above the Action Level, the OSHA requirements for monitoring, establishment of regulated areas, methods of compliance, respiratory protection, emergency response protocol, medical surveillance, training and record keeping must be followed.

STORAGE AND HANDLING PRACTICES: Entrances to regulated areas (as defined by the OSHA Benzene Standard) must be posted with signs which reads as follows:

<p style="text-align: center;">DANGER BENZENE CANCER HAZARD FLAMMABLE- NO SMOKING AUTHORIZED PERSONNEL ONLY</p>
--

All employees who handle this material should be trained to handle it safely. Avoid breathing vapors or mists generated by Benzene. Use in a well-ventilated location. Cylinders of Benzene must be properly labeled. If Benzene is used in other types of containers, only use portable containers and dispensing equipment (faucet, pump, drip can) approved for flammable liquids.

Store cylinders of Benzene in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Do not allow area where cylinders are stored to exceed 52°C (125°F). Material should be stored in secondary containers, or in a diked area, as appropriate. Store containers away from incompatible chemicals. Keep container tightly closed when not in use. Storage areas should be made of fire-resistant materials. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Refer to NFPA 30, Flammable and Combustible Liquids Code, for additional information on storage.

Empty containers may contain residual flammable liquid or vapors. Therefore, empty containers should be handled with care. Do not expose "empty" containers to welding touches, or any other source of ignition.

SPECIAL PRECAUTIONS FOR HANDLING CYLINDERS: Protect cylinders of Benzene against physical damage. If appropriate, cylinders should be stored in an up-right position. Cylinders should be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used:

Before Use: If appropriate, move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with Benzene. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Bulletin SB-2 "Oxygen Deficient Atmospheres".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use Benzene in areas where adequate ventilation is provided. Decontaminate equipment using soapy water before maintenance begins. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Use a mechanical fan or vent area to outside. Where appropriate, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Ensure eyewash/safety shower stations are available near areas where Benzene is used.

RESPIRATORY PROTECTION: Maintain exposure levels of Benzene below the levels listed in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if Benzene levels exceed exposure limits and if oxygen level is below 19.5% or during emergency response to a release of Benzene. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards. The following NIOSH respiratory protection recommendations are for Benzene.

CONCENTRATION

RESPIRATORY EQUIPMENT

At Concentrations Above the NIOSH REL, or Where there is no REL, at any Detectable Concentration: Positive-pressure, full facepiece SCBA or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

Escape: Gas mask with organic vapor cartridge or escape-type SCBA should be used.

The IDLH concentration for Benzene is 500 ppm. The carcinogenic effects of Benzene were not considered by NIOSH in determination of the IDLH.

NOTE: In areas which exceed the OSHA Action Level of Benzene, the respirator selection guidelines in the Benzene Standard [29 CFR 1910.1028 (g)] apply.

EYE PROTECTION: Splash goggles or safety glasses. Face-shields should be worn if contact with the liquid is anticipated.

HAND PROTECTION: Wear leather gloves for handling of cylinders of Benzene. Wear chemically impervious gloves appropriate for Benzene for industrial use. Gloves should have a resistance to breakthrough greater than 8 hours, such as polyvinyl alcohol, Barricade™ or Responder™. Butyl rubber, natural rubber, neoprene, nitrile rubber, or polyethylene, polyvinyl chloride, Saranex™, Chemrel™ are not recommended. Use triple gloves for spill response (see Section 6, Accidental Release Measures).

BODY PROTECTION: Use body protection appropriate for task. An impervious, full-body, encapsulating suit may be necessary for some operations involving Benzene. Safety shoes are recommended when handling cylinders.

9. PHYSICAL and CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): 2.7

SPECIFIC GRAVITY(@ 68°F (20°C) (water = 1): 0.877

SOLUBILITY IN WATER @ 77°F (25°C): 180 mg/mL

EVAPORATION RATE (diethyl ether = 1): 2.8

ODOR THRESHOLD: 97 ppm(detection); 97 ppm (recognition)

LOG COEFFICIENT WATER/OIL DISTRIBUTION: Log P (oct) = 1.18-1.9; 2.13; 2.15

VAPOR PRESSURE @ 68°F (20°C): 75 mm Hg; 10 kPa

pH: Not applicable.

FREEZING/MELTING POINT: 5.5°C (42°F)

BOILING POINT: 80°C (176°F)

SPECIFIC VOLUME: Not applicable.

EXPANSION RATIO: Not applicable.

APPEARANCE AND COLOR: Colorless, flammable liquid, with a characteristic aromatic hydrocarbon odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor of Benzene is not a good warning property as the odor threshold is above the TLV.

10. STABILITY and REACTIVITY

STABILITY: Normally stable.

DECOMPOSITION PRODUCTS: If Benzene is involved in a fire, it may ignite to yield toxic fumes of carbon monoxide, carbon dioxide, irritating aldehydes and ketones.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Benzene becomes spontaneously flammable in the presence of sodium peroxide and potassium peroxide. Benzene can explode on contact with chromic anhydride, permanganic acid and chlorine.

10. STABILITY and REACTIVITY (Continued)

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE (Continued): Benzene can react vigorously with oxidizing materials. Benzene may react violently or explosively with risk of fire with nitric acid, ozone, diborane, interhalogens (e.g., bromine trifluoride, bromine pentafluoride, chloride trifluoride, iodine pentafluoride, iodine heptafluoride), dioxygen difluoride, dioxygenyl tetrafluoroborate, permanganic acid, peroxodisulfuric acid, peroxomonosulfuric acid. Benzene will react with nitryl perchlorate, causing a slight explosion and flash. Benzene will react vigorously with uranium hexafluoride. Benzene will attack rubber and plastics.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid contact with incompatible materials, sparks, flame static discharge and other sources of ignition. Avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture or burst.

PART III *How can I prevent hazardous situations from occurring?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is available for Benzene.

Skin-Rabbit, adult 15 mg/24 hours open Mild irritation effects
Skin-Rabbit, adult 20 mg/24 hours Moderate irritation effects
Eye effects-Rabbit, adult 88 mg Moderate irritation effects
Eye effects-Rabbit, adult 2 mg/24H Severe irritation effects
orns-Human: lymphocyte 5 μ mol/L
Microsomal Mutagenicity Assay-Mouse: embryo 2500 mg/L
Oral-Mouse TDLo: 6500 mg/kg (female 8-12 days post): Reproductive effects Teratogenesis, Carcinogenesis, and Mutagenesis
Inhalation-Mouse TCLo: 5 ppm (female 6-15 days post): Teratogenic effects
Inhalation-Man TCLo: 200 mg/m³/78 weeks -intermittent: Carcinogenic effects, Blood effects
Inhalation-Human TCLo: 10 ppm/8 hours /10 years-intermittent: Carcinogenic effects, Blood effects
Oral-Rat TDLo: 52 g/kg/52 weeks - intermittent: Carcinogenic effects
Inhalation-Rat TCLo: 1200 ppm/6 hours/10 weeks - intermittent: Equivocal tumorigenic agent
Oral-Mouse TDLo :18,250 mg/kg/2 years - continuous: Carcinogenic effects
Inhalation-Human TC :8 ppb/4 weeks- intermittent: Carcinogenic effects, Blood effects
Inhalation-Dog, adult LCLo: 146,000 mg/
Inhalation-Cat, adult LCLo: 170,000 mg/m³
Inhalation-Human TC: 10 mg/m³ 3/11 years- intermittent: Carcinogenic effects, Blood effects
Inhalation-Mouse TCLo: 300 ppm/6 hours/16 weeks-intermittent: Equivocal tumorigenic agent
Skin-Mouse TDLo: 1200 g/kg/49 weeks - intermittent: Neoplastic effects
Intraperitoneal-Mouse TDLo: 1200 mg/kg/8 weeks - intermittent: Neoplastic effects

Inhalation-Man TC: 150 ppm/11 years - intermittent: Carcinogenic effects, Blood effects
Inhalation-Mouse TC :1200 ppm/6 hours/10 weeks - intermittent: Equivocal tumorigenic agent
Oral-Mouse TD: 2400 mg/kg/8 weeks - intermittent: Neoplastic effects
Inhalation-Mouse TC: 300 ppm/6 hours/16 weeks intermittent: Carcinogenic effects
Inhalation-Human LCLo :2 pph/5 minutes
Oral-Man LDLo: 50 mg/kg
Inhalation-Human LCLo: 20,000 ppm/5
Inhalation-Man TCLo: 150 ppm/1 year - intermittent: Blood effects
Inhalation-Human TCLo: 100 ppm
Intravenous-Rabbit, adult LDLo :88 mg/kg
Inhalation-Human LCLo: 65 mg/m³/5 years: Blood effects
Oral-Rat LD50: 3306 mg/kg
Inhalation-Rat LC50: 10,000 ppm/7 hours
Intraperitoneal-Rat LD50 :2890 μ g/kg
Oral-Mouse LD50: 4700 mg/kg
Inhalation-Mouse LC50: 9980 ppm
Intraperitoneal-Mouse LD50: 340 mg/kg
Oral-Dog, adult LDLo: 2000 mg/kg
Subcutaneous-Mouse TDLo 600 mg/kg/17 weeks - intermittent: Equivocal tumorigenic agent
Parenteral-Mouse TDLo: 670 mg/kg/19 weeks - intermittent: Equivocal tumorigenic agent
Inhalation-Human TC: 150 ppm/15 minutes /8 years - intermittent: Carcinogenic effects, Blood effects
Oral-Rat TD: 52 g/kg/1 years - intermittent: Carcinogenic effects
Oral-Rat TD: 10 g/kg/52 weeks - intermittent: Carcinogenic effects
Inhalation-Man TC :600 mg/m³/4 years - intermittent: Carcinogenic effects, Blood effects

Additional Information on Benzene: Because of the chronic toxicity effects associated with Benzene, additional information is provided, as follows:

EFFECTS ON THE BLOOD AND BLOOD-FORMING ORGANS: Extensive studies have conclusively proven that oral and inhalation exposure to benzene causes severe effects on the blood system, including damaging the bone marrow where new blood cells are formed. Most studies report a decrease in hemoglobin, hematocrit, red and white blood cells, platelets and/or changes in the cells. Effects of varying severity have been demonstrated with both intermittent and continuous exposures to concentrations as low as 10 ppm for 24 weeks.

EFFECTS ON THE IMMUNE SYSTEM: Studies have also conclusively shown that benzene causes harmful changes to the immune system which protects the body from disease. Benzene has decreased the number of mature B- and T-lymphocytes (white blood cells which produce disease-fighting antibodies). Exposure of mice to 300 ppm for 6 to 23 weeks resulted in a decrease in the number of mature B- and T-lymphocytes. Rats and mice exposed orally to 25 to 200 mg/kg/day for 2 years had significantly reduced white blood cells and lymphocytes.

11. TOXICOLOGICAL INFORMATION (Continued)

SUSPECTED CANCER AGENT: Benzene is listed as follows:

BENZENE ACGIH-A2 (Suspected Human Carcinogen); EPA-A (Human Carcinogen); IARC-1 (Carcinogenic to Humans); MAK-A1 (Capable of Inducing Malignant Tumors/Experience with Humans); NIOSH-X (Carcinogen); NTP-1 (Known to be a Carcinogen); OSHA-X (Carcinogen); Cal-OSHA (Carcinogen).

IRRITANCY OF PRODUCT: Benzene is irritating to the skin, eyes, and other contaminated tissue.

SENSITIZATION OF PRODUCT: Benzene is not known to cause respiratory system or skin sensitization in humans. Cardiac sensitization to stimulants (e.g., epinephrine, ephedrine) is a possible result of severe or chronic overexposure.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Benzene on the human reproductive system.

Mutagenicity: Human mutation data are available for Benzene. These data were obtained from individuals who were exposed at levels which produced changes in the blood system.

Embryotoxicity: Benzene is not reported to cause embryotoxic effects in humans.

Teratogenicity: Benzene is not reported to cause teratogenic effects in humans. Teratogenic data are available from clinical studies involving test animals exposed to relatively high doses of Benzene. Fetotoxic effects (e.g., reduced birth weight and/or minor skeletal variations) were observed at exposures above 50 ppm.

Reproductive Toxicity: Data on reproductive effects on ovaries and testes are available from clinical studies involving test animals exposed to relatively high doses of Benzene. These data were obtained at doses which caused toxic effects on other organs.

*A **mutagen** is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An **embryotoxin** is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance which interferes in any way with the reproductive process.*

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing blood system disorders, respiratory conditions, central nervous, liver, kidney, and cardio-vascular condition may be aggravated by severe or chronic overexposure to Benzene. Skin disorders may also be aggravated by exposures to Benzene.

RECOMMENDATIONS TO PHYSICIANS: The following guidelines are derived from "Clinical Toxicology of Commercial Chemical Products" (5th edition, 1984).

- Check for signs of impending pulmonary edema.
- Because of the aspiration hazard, avoid emetic drugs, whenever practical.
- For overexposures in which emesis is advisable: If the patient is not drowsy, comatose, or in respiratory difficulty, induce vomiting. If necessary, as an alternative treatment, remove Benzene from the stomach via gastric lavage. One or two ounces of mineral oil may be instilled and left in the stomach at the completion of lavage.
- Avoid epinephrine because of its possible adverse effect on the sensitized myocardium. Avoid all digestible fats, oils and alcohol, which may promote the absorption of Benzene in the intestinal system.
- If eyes or skin are affected, wash thoroughly and apply a bland analgetic ointment.
- Because of the possibility of ventricular fibrillation, monitor the ECG continuously and be prepared to administer external cardiac massage.

Refer to the OSHA Benzene Standard [29 CFR 1910.1028; paragraph(i) and Appendix C] for specific information on Medical Surveillance requirements (i.e. for the general physical exam, medical history, specific tests, and re-examination protocol).

BIOLOGICAL EXPOSURE INDICES (BEIs): The following Biological Exposure Indices (BEIs) are currently applicable for Benzene.

BIOLOGICAL EXPOSURE INDICES (BEIs) for Benzene are as follows:		
CHEMICAL DETERMINANT	SAMPLING TIME	BEI
BENZENE • Total phenol in urine • Benzene in exhaled air: mixed-exhaled end-exhaled	• End of shift • Prior to next shift	• 50 mg/g creatinine • 0.08 ppm • 0.12 ppm

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Benzene will be degraded over time into other organic compounds. The following environmental data are available for Benzene.

BENZENE. $K_{OW} = 2.13$. Water Solubility = 1791 mg/L. BCF (*Anguilla japonica*, eels) = 3.5. BCF (*Clupea harengus* *Pallas*, pacific herring) = 4.4. BCF (goldfish) = 4.3. BCF, benzene = 24 (estimated). If benzene is released into the soil, it will be volatilized near the surface or it will leach to the groundwater. No degradation of benzene (BOD) was reported in coarse-filtered Lake Superior harbor water incubated at 21°C for 12 days. In the marine eco-system, biodegradation occurs from 2 days to 2 weeks in the summer and spring, respectively. The half-life of Benzene in estuarine water was 6 days, as measured by $^{14}\text{CO}_2$ produced. Biodegradation half-lives of 28 and 16 days were reported in die-away tests for degradation of up to 3.2 UL/L benzene using groundwater and Lester River water, respectively, under aerobic conditions. In a base-rich parabrownish soil, 20 ppm benzene was 24% degraded in one week, 44% in 5 weeks and 47% in 10 weeks. It is not expected to adsorb to sediment nor bioconcentrate in aquatic organisms.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Benzene may be harmful or fatal to contaminated plant and animal-life (especially if large quantities of Benzene are released). Refer to Section 11 (Toxicology Information). Additional information is available on the effects of Benzene on plants as follows:

Benzene is lethal to plants at high concentrations (GT 15600 ppm in air) and short (30 minutes) exposure times. In all species studied recovery was complete upon removal from exposure to sub-lethal concentrations.

Plant growth and rooting is stimulated by aqueous solutions of low benzene concentrations (0.01-0.10 saturated). Aqueous solutions containing high concentrations (0.10-0.15% Benzene) inhibit growth and interfere with metabolism and cell division.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Benzene can be harmful or fatal to contaminated aquatic plant and animal life. Benzene floats on water, and can potentially form slicks which are capable of creating oxygen-deprived waterways which can contaminate coastal and shore life. The following aquatic toxicity data are available for Benzene.

LC₁₀₀ (*Tetrahymena pyriformis*, ciliate) = 12.8 mmol/L/24 hours
LC₅₀ (*Paiaemonetes pugio*, grass shrimp) = 27 ppm/96 hours
LC₅₀ (*Cancer magister*, crab larvae, stage 1) = 108 ppm/96 hours
LC₅₀ (*Crangon franciscorum*, shrimp) = 20 ppm/96 hours
LC₅₀ (*Poecilia reticulata*, guppy) = 63 ppm/14 days
LC₅₀ (*Morone saxatilis*, bass) = 5.8 to 10.9 ppm/96 hours
LC₅₀ (*Salmo trutta*, brown trout yearling) = 12 mg/L/1-hour
LC₅₀ (*Ambystoma mexicana*, mexican axotoll salamander, 3-4 weeks after hatching) = 370 mg/L/48 hours
LC₅₀ (clawed toad, 3-4 weeks after hatching) = 190 mg/L/48 hours
LD₅₀ (*Carassius auratus*, goldfish) = 46 mg/L/24-hours
LD₅₀ (*Lepomis macrochirus*, bluegill sunfish) = 60 mg/L/2-hours

LC (*Daphnia magna*) highest no adverse level = 98 mg/L
Effect level (blue crab) = 1 mg/L
EC₅₀ (freshwater green algae, *Ankistrodesmus falcatus*) = 310 mg (3.97 mmol/L)
Photosynthetic carbon fixation (*Selenastrum capricornutum*) = 100, 95, 84, 5, for 24 hour exposure to 0, 10, 100 or 1000 mg Benzene/L
Growth inhibition (*Chlorella vulgaris*) = significant for 25-1744 ppm Benzene
Light saturated photosynthesis relative rates (*Nitzschia palea*, freshwater diatom) = 100, 61, 38, 13; exposure for 2 hours to 0, 175, 350, 520 mg Benzene/L
Growth inhibition (*Skeletonema costatum*) = at 20 mg/L

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with residual product to Airgas Inc. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

<u>PROPER SHIPPING NAME:</u>	Benzene
<u>HAZARD CLASS NUMBER and DESCRIPTION:</u>	3 (Flammable Liquid)
<u>UN IDENTIFICATION NUMBER:</u>	UN 1114
<u>PACKING GROUP:</u>	PG II
<u>DOT LABEL(S) REQUIRED:</u>	Flammable Liquid
<u>NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):</u>	130

MARINE POLLUTANT: Benzene is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments. Also, there is an additional Hazard Class: 9.2 (Substance Hazardous to the Environment).

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Benzene is subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act., as follows:

COMPONENT	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Benzene	NO	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITIES (RQ): 10 lb; RCRA Code = U019.

CANADIAN DSL/NDL INVENTORY STATUS: Benzene is on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Benzene is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Benzene is subject to the requirements of CFR 29 1910.1028, the OSHA Benzene Standard. The Action Level for Benzene is 0.5 ppm as an 8-hour, time-weighted average under this regulation. The EPA is promulgating water regulations for certain volatile synthetic organic chemicals. Specifically, this notice promulgates a maximum contaminant level for Benzene at 0.005 mg/L. Benzene is not listed in Appendix A as a highly hazardous chemical, per 29 CFR 1910.119: Process Safety Management of Highly Hazardous Chemicals. Under this regulation, however, any process that involves a flammable liquid on-site, in one location, in quantities of 10,000 lbs (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Benzene is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Benzene

California - Permissible Exposure Limits for Chemical Contaminants: Benzene.

Florida - Substance List: Benzene.

Illinois - Toxic Substance List: Benzene

Kansas - Section 302/313 List: Benzene.

Massachusetts - Substance List: Benzene.

Michigan Critical Materials Register: Benzene.

Minnesota - List of Hazardous Substances: Benzene.

Missouri - Employer Information/Toxic Substance List: Benzene.

New Jersey - Right to Know Hazardous Substance List: Benzene.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: Benzene.

Pennsylvania - Hazardous Substance List: Benzene.

Rhode Island - Hazardous Substance List: Benzene.

Texas - Hazardous Substance List: Benzene.

West Virginia - Hazardous Substance List: Benzene.

Wisconsin - Toxic and Hazardous Substances: Benzene.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Benzene is listed on the California Proposition 65 Lists. WARNING: Benzene is known to the State of California to cause cancer.

LABELING: **DANGER!** EXTREMELY FLAMMABLE LIQUID AND VAPOR. VAPOR CAN CAUSE FLASH FIRE. FLASH POINT = -11°C (12°F). HARMFUL IF INHALED. HARMFUL OR FATAL IF SWALLOWED. PROLONGED OR REPEATED SKIN CONTACT MAY DRY SKIN AND CAUSE IRRITATION. CAN CAUSE CENTRAL NERVOUS SYSTEM EFFECTS. CHRONIC EXPOSURE MAY CAUSE LEUKEMIA AND CAN CAUSE ADVERSE EFFECTS ON THE BLOOD SYSTEM, LIVER, KIDNEYS, REPRODUCTIVE SYSTEM. CAN CAUSE DEATH IF TOO MUCH IS BREATHED. ASPIRATION HAZARD IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation. Avoid contact with skin and clothing. Avoid exposure to vapor. Wash thoroughly after handling. FIRST-AID: In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if irritation develops or persists. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of fire, use water fog, foam, dry chemical, or CO₂. In case of spill: Absorb spill with inert materials (e.g. activated carbon, dry sand). Flush residual spill with water. Consult Material Safety Data Sheet for additional information.

CANADIAN WHMIS SYMBOLS: Class B2: Flammable Liquid.
Class D2A/D2B: Material Causing Other Toxic Effects



16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (TWA), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (C). Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register, 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL" is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. The **DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL.

NIOSH is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (OSHA). NIOSH issues exposure guidelines called Recommended Exposure Levels (RELs). When no exposure guidelines are established, an entry of NE is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: 0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: 0 (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); 2 (materials that are unstable but do not detonate or which can react violently with water); 3 (materials that can detonate when initiated or which can react explosively with water); 4 (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure could cause serious temporary or residual injury); 4 (materials that under very short exposure causes death or major residual injury).

NATIONAL FIRE PROTECTION ASSOCIATION (Continued):

Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (NFPA). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature - The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** - concentration expressed in parts of material per million parts of air or water; **mg/m³** - concentration expressed in weight of substance per volume of air; **mg/kg** - quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program; **RTECS** - the Registry of Toxic Effects of Chemical Substances; **OSHA** and **CAL/OSHA**. **IARC** and **NTP** rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo**, the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: **EC** is the effect concentration in water.

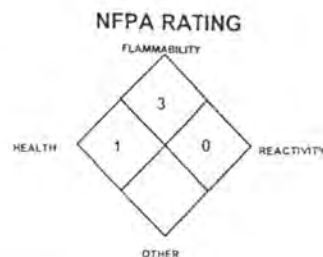
REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (SARA); the Canadian Domestic/Non-Domestic Substances List (DSL/NDL); the U.S. Toxic Substance Control Act (TSCA); Marine Pollutant status according to the DOT; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund); and various state regulations.



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards



PART I What is the material and what do I need to know in an emergency?

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

ACETONE - C₃H₆O
Document Number: 001088

PRODUCT USE:

General Chemical Use; Solvent

SUPPLIER:

AIRGAS INC.

ADDRESS:

259 N. Radnor-Chester Road
Suite 100
Radnor, PA 19087-5283

BUSINESS PHONE:

1-610-687-5253

EMERGENCY PHONE:

CHEMTREC: 1-800-424-9300
International: 703-527-3887 (Call Collect)

DATE OF PREPARATION:

June 15, 1999

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		OSHA-PEL		IDLH ppm	OTHER ppm
			TWA ppm	STEL ppm	TWA ppm	STEL ppm		
Acetone	67-64-1	100%	500, A4 (Not Classifiable as Human Carcinogen)	750, A4 (Not Classifiable as Human Carcinogen)	1000 750 (Vacated 1989 PEL)	1000 (Vacated 1989 PEL)	2500 (Based on 10% LEL)	NIOSH RELs: TWA = 250 DFG MAKs: TWA = 500 PEAK = 2 MAK 5 min., momentary value CARCINOGEN: EPA-D; MAK-B

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1998 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Acetone is a clear, colorless, mobile, flammable liquid with a fragrant fruity or mint-like odor. Inhalation of Acetone's vapors can irritate the upper respiratory system and cause central nervous system depression (producing symptoms such as headaches, drowsiness, and confusion). Inhalation of high concentrations of the vapors may be fatal if cardio-respiratory failure occurs. Direct skin or eye contact may be irritating. Vapors of Acetone may spread long distances; distant ignition and flashback are possible. Acetone is not reactive. Emergency responders must wear the proper personal protective equipment (and have appropriate fire-suppression equipment) suitable for the situation to which they are responding.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:

The most significant routes of occupational overexposure are by inhalation, skin and eye contact. The symptoms of overexposure to Acetone are as follows:

INHALATION: Inhalation of Acetone vapors will cause central nervous system depression. The symptoms of such exposure can include headaches, nausea, dizziness, drowsiness, confusion, slurred speech, nausea, vomiting and unconsciousness. Because Acetone is metabolized slowly, effects can be delayed. Irritation of the nose, throat, and other tissues of the upper respiratory system may also occur. Severe inhalation overexposures can result in anesthesia (loss of feeling), cardiac effects including tachycardia and hypotension, as well as serious respiratory depression, leading to cardiovascular and respiratory collapse, coma and death. Chronic inhalation exposure can result in inflammation of airways, stomach and duodenum, as well as dizziness and loss of strength. Chronic inhalation exposure can also lead to liver damage.

CONTACT WITH SKIN or EYES: Contact of the liquid with the eyes may cause redness and pain. Direct contact with the skin (especially after prolonged overexposure) can cause irritation. Prolonged or repeated skin overexposures can cause dermatitis.

SKIN ABSORPTION: Skin absorption is a potential route of overexposure for Acetone, but is not considered a serious route of exposure.

INGESTION: Ingestion of Acetone can cause irritation of the throat, esophagus, and stomach. Ingestion of large quantities will cause central nervous system depression and effects described under "Inhalation".

INJECTION: Injection is not anticipated to be a significant route of overexposure for Acetone. If Acetone is "injected" (as may occur through punctures by contaminated, sharp objects), local swelling and irritation can occur. Depending on the degree of injection overexposure, symptoms described under "Inhalation" may develop.



OTHER HEALTH EFFECTS: Exposure to Acetone may enhance liver toxicity of chlorinated solvents, such as 1,1-dichloroethylene and 1,1,2-trichloroethane.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms.

ACUTE: Inhalation of Acetone vapors can irritate the upper respiratory system and cause central nervous system depression (producing symptoms such as headaches, drowsiness, and confusion). Serious acute Inhalation, or ingestion of Acetone may cause severe depression of respiratory and cardiovascular systems. Inhalation of high concentrations of the vapors or ingestion may be fatal. Symptoms can be delayed. Direct skin or eye contact may be irritating.

CHRONIC: Prolonged or repeated skin overexposures can cause dermatitis. Chronic inhalation of Acetone vapors can cause liver damage, inflammation of respiratory system and muscle weakness. Refer to Section 11 (Toxicology Information) for additional information.

TARGET ORGANS: **Acute:** Skin, eyes, central nervous system, cardiovascular system. **Chronic:** Skin, respiratory system, liver.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM			
HEALTH		(BLUE)	1
FLAMMABILITY		(RED)	3
REACTIVITY		(YELLOW)	0
PROTECTIVE EQUIPMENT			C
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For routine industrial applications.			

See Section 16 for Definition of Ratings

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

SKIN EXPOSURE: If Acetone contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek medical attention if any adverse reaction occurs.

EYE EXPOSURE: If Acetone liquid or vapors enter the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention.

INHALATION: If vapors, mists, or sprays of Acetone are inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Remove or cover gross contamination to avoid exposure to rescuers.

INGESTION: If Acetone is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. DO NOT INDUCE VOMITING. Have victim rinse mouth with water, if conscious. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration.

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Take copy of label and MSDS to health professional with victim.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions, central nervous system conditions, eye disorders, or skin problems may be aggravated by overexposure to Acetone.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate exposure. If necessary, administer liver function tests, and eye and vision exams. The following treatment is suggested for various alcohols, and is given as symptoms of Acetone poisoning resembles that of ethyl alcohol:

- Gastric lavage with 3-5% sodium bicarbonate, unless more than 2 hours have elapsed since ingestion occurred. Do not use apomorphine. Syrup of ipecac may be a safe way to empty stomach, if given promptly after ingestion.
- Oxygen and artificial respiration as needed for hypoventilation.
- Treat for circulatory collapse, dehydration and acidosis by intravenous infusions of isotonic sodium chloride or sodium bicarbonate.
- Intravenous glucose can be administered if hypoglycemia occurs.
- Hemodialysis can be done in severe cases in which the alkali treatment may be delayed or is incomplete.
- Keep patient warm. Avoid aspiration of vomitus.

5. FIRE-FIGHTING MEASURES

FLASH POINT: -18°C (0°F) [TCC]; -9°C (15°F) [TOC]

AUTOIGNITION TEMPERATURE: 465°C (869°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 2.6%
Upper (UEL): 12.8%

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES Carbon Dioxide: YES
Foam: YES Dry Chemical: YES
Halon: YES Other: Any "B" Class.

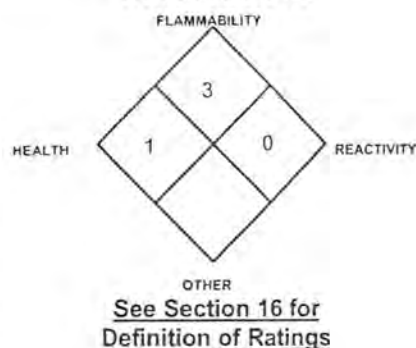
UNUSUAL FIRE AND EXPLOSION HAZARDS: This is a Class IB flammable liquid. When involved in a fire, this material will ignite and produce toxic gases (including carbon monoxide and carbon dioxide). The vapors of Acetone may spread long distances. Distant ignition and flash-back are possible.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Static discharge may cause Acetone to ignite.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Water spray can be used to cool fire-exposed containers. Water fog or spray can also be used by trained fire-fighters to disperse Acetone's vapors and to protect personnel. If this liquid is involved in a fire, fire runoff water should be contained to prevent possible environmental damage. If necessary, decontaminate fire-response equipment with soap and water solution.

NFPA RATING



6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a spill, clear the affected area and protect people. Eliminate all sources of ignition before clean-up begins. Use non-sparking tools. There is a colorimetric tube available for Acetone. There is a colorimetric tube available for Acetone. If a colorimetric tube is used during spill response, the reading must not be above background levels before non-emergency personnel are allowed into the release area. The atmosphere must have levels of Acetone lower than those listed in Section 2, (Composition and Information on Ingredients) and at least 19.5 percent oxygen before personnel can be allowed into the area without Self-Contained Breathing Apparatus (SCBA).

For small spills, absorb spilled liquid with polypads or other suitable absorbent materials, wearing gloves, goggles and apron. In the event of a non-incidental release, minimum Personal Protective Equipment should be **Level B: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), chemically resistant suit and boots, hard-hat, and Self-Contained Breathing Apparatus**. Monitor area for combustible vapor levels. The level of vapors must be below 10% of the LEL (LEL = 2.6%), before personnel are allowed into the spill area. Absorb spilled liquid with activated carbon, polypads, or other suitable absorbent materials. Decontaminate the area thoroughly. Prevent material from entering sewer or confined spaces. Place all spill residue in a double plastic bag and seal. Dispose of in accordance with applicable U.S. Federal, State, or local procedures, or appropriate Canadian standards (see Section 13, Disposal Considerations).

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling this product. Do not eat, drink, smoke, or apply cosmetics while handling this product. Avoid breathing vapors or mists generated by this product. Use in a well-ventilated location. Remove contaminated clothing immediately.

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Keep away from heat, sparks, and other sources of ignition. Keep container tightly closed when not in use. Use non-sparking tools. Bond and ground containers during transfers of material. If this product is transferred into another container, only use portable containers and dispensing equipment (faucet, pump, drip can) approved for flammable liquids.

Store containers in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Material should be stored in secondary containers or in a diked area, as appropriate. Store containers away from incompatible chemicals (see Section 10, Stability and Reactivity). Containers should be separated from oxidizing materials by a minimum distance of 20 ft. or by a barrier of non-combustible material at least 5 ft. high having a fire-resistance rating of at least 0.5 hours. Storage areas should be made of fire resistant materials. Post warning and "NO SMOKING" signs in storage and use areas, as appropriate. Have appropriate extinguishing equipment in the storage area (i.e., sprinkler system, portable fire extinguishers). Inspect all incoming containers before storage to ensure containers are properly labeled and not damaged. Refer to NFPA 30, *Flammable and Combustible Liquids Code*, for additional information on storage.

Empty containers may contain residual liquid or vapors which are flammable; therefore, empty containers should be handled with care. Never perform any welding, cutting, soldering, drilling, or other hot work on an empty container or piping until all liquid, vapors, and residue have been cleared.

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely, if necessary. Collect all rinsates and dispose of according to applicable U.S. Federal, State, or local procedures and appropriate Canadian standards.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Use a mechanical fan or vent area to outside. Where appropriate, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Ensure eyewash/safety shower stations are available near areas where Acetone is used.

RESPIRATORY PROTECTION: Maintain airborne contaminant concentrations below exposure limits listed in Section 2 (Composition and Information on Ingredients), if applicable. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

RESPIRATORY PROTECTION (continued): For additional information, the following NIOSH recommendations for respiratory protection are provided for Acetone.

CONCENTRATION

Up to 2500 ppm:

RESPIRATORY EQUIPMENT

Chemical cartridge respirator with organic vapor cartridge, or powered air-purifying respirator with organic vapor cartridge(s), or gas mask with organic vapor canister, or Supplied Air Respirator (SAR), or full-facepiece Self-Contained Breathing Apparatus (SCBA).

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive pressure, full facepiece SCBA or positive pressure, full facepiece SAR with an auxiliary positive pressure SCBA.

Escape: Gas mask with organic vapor canister, or escape-type SCBA should be used.

The IDLH concentration for Acetone is 2500 ppm.

EYE PROTECTION: Splash goggles or safety glasses, with faceshield.

HAND PROTECTION: Wear butyl rubber, Teflon™, Barricade™, Chemrel™, or similar gloves for routine industrial use. Use triple gloves for spill response, as stated in Section 6 (Accidental Release Measures) of this MSDS.

BODY PROTECTION: Use body protection appropriate for task. Coveralls, chemically-resistant boots, and other body protection may be appropriate, depending on the operation in which Acetone is used.

9. PHYSICAL and CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): 2.0

SPECIFIC GRAVITY (water = 1): 0.791

SOLUBILITY IN WATER: Soluble.

EVAPORATION RATE (n-BuAc = 1): Not established.

EXPANSION RATIO: Not applicable.

VAPOR PRESSURE @ 20°C: 180 mm Hg

LOG COEFFICIENT WATER/OIL DISTRIBUTION: -0.24

APPEARANCE, ODOR AND COLOR: Acetone is a clear, colorless, mobile liquid with a fruity or mint-like odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor may be a distinctive characteristic of Acetone, if accidentally released.

pH: Not applicable.

FREEZING/MELTING POINT: -95.4°C (-139.7°F)

BOILING POINT: 56.2°C (133.2°F)

ODOR THRESHOLD: 200-400 ppm

SPECIFIC VOLUME: Not determined.

MOLECULAR WEIGHT: 58.08

10. STABILITY and REACTIVITY

STABILITY: Stable at standard temperatures and pressures.

DECOMPOSITION PRODUCTS: When ignited in air, the products of thermal decomposition include carbon monoxide, carbon dioxide, and formaldehyde.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Acetone reacts violently with strong oxidizing agents, and chlorinated solvent/alkali mixtures. Acetone reacts vigorously with hexachloromelamine, sulfur dichloride and potassium *tert*-butoxide.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks and other sources of ignition.

PART III *How can I prevent hazardous situations from occurring?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are currently available for Acetone.

Standard Draize Test (Eye-Human) 500 ppm
Standard Draize Test (Eye effects-Rabbit, adult) 3950 :Severe irritation effects

Standard Draize Test (Eye effects-Rabbit, adult) 20 mg/24 hours Moderate irritation effects

Standard Draize Test (Skin-Rabbit, adult) 395 mg open Mild irritation effects

Standard Draize Test (Skin-Rabbit, adult) 500 mg/24 hours Mild irritation effects

LD₅₀ (Oral-Rat) 5800 mg/kg

LD₅₀ (Oral-Mouse) 3000 mg/kg

LD₅₀ (Oral-Rabbit, adult) 5340 mg/kg

LD₅₀ (Skin-Rabbit, adult) 20 g/kg

LD₅₀ (Intravenous-Rat) 5500 mg/kg

LD₅₀ (Intravenous-Rat) 5500 mg/kg

LD₅₀ (Intraperitoneal-Mouse) 1297 mg/kg

LDLo (Intravenous-Mouse) 4 g/kg

LDLo (Intraperitoneal-Rat) 500 mg/kg

TDLo (Oral-Man) 2857 mg/kg

TDLo (Inhalation-Man) 440 g/m³/6 minutes

TDLo (Inhalation-Man) 10 mg/m³/6 hours

TDLo (Oral-Rat) 273 gm/kg; male 13 week(s)

pre-mating: Reproductive: Paternal Effects: spermatogenesis (incl genetic material, sperm morphology, motility, and count)

LDLo (Oral-Dog, adult) 8 g/kg

LC₅₀ (Inhalation-Rat) 50,100 mg/m³/8 hours

LCLo (Inhalation-Mouse) 110 g/m³/1 hour

TCLo (Inhalation-Human) 500 ppm: Eye effects

TCLo (Inhalation-Man) 12,000 ppm/4 hours: Central nervous system effects

TCLo (Inhalation-Man) 12,000 ppm/4 hours: Gastrointestinal tract effects

TCLo (Inhalation: Mammal-species unspecified) 31500 µg/m³/24 hours: female 1-13 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants)

TCLo (Inhalation-Mammal) 31,500: g/m³/24 hours (1-13 days preg): Reproductive effects

11. TOXICOLOGICAL INFORMATION (Continued)

TOXICITY DATA (continued):

Cytogenetic Analysis (Saccharomyces cerevisiae) 200 mmol/tube

Sex Chromosome Loss and Nondisjunction (Saccharomyces cerevisiae) 47,600 ppm

Sex chromosome loss and nondisjunction (Saccharomyces cerevisiae) 47600 ppm
Cytogenetic Analysis (Hamster-Fibroblast) 40 gm/L

SUSPECTED CANCER AGENT: Acetone is listed as follows:

EPA-D (Not Classifiable as to Human Carcinogenicity - inadequate human and animal evidence of carcinogenicity or no data available)

ACGIH TLV-A4 (Not Classifiable as a Human Carcinogen - agent which causes concern that it could be carcinogenic for humans, but which cannot be assumed conclusively because of lack of data.

Acetone is not found on the following lists: FEDERAL OSHA Z LIST, NTP, IARC, or CAL/OSHA, and is therefore not considered to be, nor suspected to be, a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: The liquid or vapors of Acetone can be irritating to contaminated tissue.

SENSITIZATION OF PRODUCT: Acetone is not known to cause sensitization in humans after prolonged or repeated exposures.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Acetone on the human reproductive system.

Mutagenicity: Acetone is not reported to produce mutagenic effects in humans. Data are available for Acetone in microorganisms.

Embryotoxicity: Acetone is not reported to produce embryotoxic effects in humans.

Teratogenicity: Acetone is not reported to cause teratogenic effects in humans.

Reproductive Toxicity: Acetone is not reported to cause reproductive effects in humans. Clinical studies on test animals exposed to relatively high doses of this compound indicate reproductive effects.

A *mutagen* is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An *embryotoxin* is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A *teratogen* is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A *reproductive toxin* is any substance which interferes in any way with the reproductive process.

BIOLOGICAL EXPOSURE INDICES: The following Biological Exposure Indices (BEIs) are associated with Acetone:

CHEMICAL DETERMINANT	SAMPLING TIME	BEI
ACETONE Acetone in urine	End of shift	100 mg/L

12. ECOLOGICAL INFORMATION

ALL WORK PRACTICES MUST BE AIMED AT ELIMINATING ENVIRONMENTAL CONTAMINATION.

ENVIRONMENTAL STABILITY: Acetone will be degraded over time into other organic compounds. The following environmental data are available for Acetone:

Estimated Log K_{ow} = -0.24; Estimated Log K_{oc} = 1; Water Solubility = Miscible

Biodegradation: Although Acetone is quite readily degraded in the environment, the primary removal of Acetone is through evaporation. BOD = 122%; 5 days.

Bioconcentration: The potential for bioconcentration in fish is negligible. One experimental study of bioconcentration in adult haddock at 7-9°C (static test) resulted in a BCF of 0.69

Mobility/Soil Adsorption: Acetone is expected to be very mobile in soil, based on estimated Log K_{ow} and Log K_{oc} values. Acetone has shown no adsorption to montmorillonite, kaolin clay or stream sediment.

Persistence: If released to soil, Acetone is expected to volatilize (from moist soil surfaces). Acetone will be highly mobile in soil, possible leaching to groundwater. Acetone is expected to biodegrade from soils. If released to water, Acetone will not adsorb to suspended solids or sediments. Acetone is expected to volatilize from water surfaces to the atmosphere. The estimated half-lives of Acetone in a model river and model lake are 38 and 33 hours, respectively. If released to the atmosphere, Acetone will exist solely as a vapor in the atmosphere. Vapor-phase acetone is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals. The half-life for this reaction in air is estimated to be 71 days. The average rate of photodissociation of Acetone by natural sunlight in the lower troposphere has been measured as 1×10^{-7} sec-⁻¹. This corresponds to a half-life of about 80 days.

EFFECT OF MATERIAL ON PLANTS OR ANIMALS: Acetone may be harmful or fatal to contaminated plant and animal-life (especially if large quantities of Acetone are released). Refer to section 11 (Toxicological Information) for additional information on effects on animals. The following data are available for bird life:

LC₅₀ (Japanese quail) = 40,000 ppm, in diet, age 14 days, (no mortality to 40,000 ppm)

LC₅₀ (Ring-necked pheasant) = 40,000 ppm, in diet, age 10 days, (no mortality to 40,000 ppm)

12. ECOLOGICAL INFORMATION (Continued)

EFFECT OF CHEMICAL ON AQUATIC LIFE: Acetone can be harmful or fatal to contaminated aquatic plant and animal life. The following aquatic toxicity data are available for Acetone:

TLm (<i>Daphnia magna</i>) 24 and 48 hours = 10 mg/L (conditions of bioassay not specified)	LC ₅₀ (<i>Gammarus pulex</i>) = 5,500 mg/L
TLm (brine shrimp) 24 and 48 hours = 2100 mg/L, (conditions of bioassay not specified)	LC ₅₀ (<i>Pimephales promelas</i>) 96 hours = 8,120 mg/L, (conditions of bioassay not specified)
NOEC (<i>Daphnia magna</i>) reproduction = 3,200 mg/L	LC ₅₀ F (fingerling trout) 24 hours = 6,100 mg/L
NOEC (<i>Daphnia magna</i>) growth = 1,000 mg/L	LD ₁₀₀ (<i>Asellus aquaticus</i>) within 3 days = 3 mL (conditions of bioassay not specified)
LC ₅₀ (mosquito fish) 24-96 hours = 13,000 mg/L	LD ₁₀₀ (<i>Gammarus fossarum</i>) 48 hours = 10 mL/L, (conditions of bioassay not specified)
LC ₅₀ (goldfish) 24 hours = 5,000 mg/L	EC ₀ (<i>Pseudomonas putida</i> bacteria) 16 hours = 1,700 mg/L
LC ₅₀ (<i>Lepomis macrochirus</i> bluegill sunfish) 96 hours = 8,300 mg/L	EC ₀ (<i>Microcystis aeruginosa</i> algae) 8 days = 530 mg/L
LC ₅₀ (<i>Poecilia reticulata</i> guppy) 14 days = 7,032 mg/L	EC ₀ (<i>Scenedesmus quadricauda</i> green algae) 7 days = 7,500 mg/L
LC ₅₀ (Mexican axolotl 3-4 w after hatching) 48 hours = 20,000 mg/L	EC ₀ (<i>Entosiphon sulcatum</i> protozoa) 72 hours = 28 mg/L
LC ₅₀ (clawed toad 3-4 w after hatching) 48 hours = 24,000 mg/L	EC ₀ (<i>Uronema parduczi</i> Chatton-Lwoff protozoa) = 1,710 mg/L
LC ₅₀ (<i>Daphnia magna</i>) growth = 17,100 mg/L	EC ₅₀ (<i>Daphnia magna</i>) reproduction = 4,000 mg/L
LC ₅₀ (<i>Salmo gairdneri</i> , rainbow trout) 86 hours = 5,540 mg/L @ 12°C; (95% confidence limit 4,740-6,330 mg/L), wt 1.0 g (static bioassay)	

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Do not dispose of locally.

U.S. EPA WASTE NUMBER: D001 (Characteristic, Ignitability), applicable to wastes consisting only of this compound.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Acetone
HAZARD CLASS NUMBER and DESCRIPTION:	3 (Flammable Liquid)
UN IDENTIFICATION NUMBER:	UN 1090
PACKING GROUP:	PG II
DOT LABEL(S) REQUIRED:	Flammable Liquid
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 127	
MARINE POLLUTANT: Acetone is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).	

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the following information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: Acetone is subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Acetone	NO	YES	NO

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for Acetone. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. CERCLA REPORTABLE QUANTITIES (RQ): 5000 lb. (2270 kg)

U.S. TSCA INVENTORY STATUS: Acetone is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Depending on specific operations involving the use of Acetone, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation, Acetone is not listed in Appendix A; however, any process that involves a flammable liquid on-site, in one location, in quantities of 10,000 lb (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

15. REGULATORY INFORMATION (Continued)

U.S. STATE REGULATORY INFORMATION: Acetone is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Acetone.

California - Permissible Exposure Limits: Acetone.

Florida - Substance List: Acetone.

Illinois - Toxic Substance List: Acetone.

Kansas - Section 302/313 List: Acetone.

Minnesota - List of Hazardous Substances: Acetone.

Massachusetts - Substance List: Acetone.

Michigan - Critical Materials Register: No.

Missouri - Employer Information/Toxic Substance List: Acetone.

New Jersey - Right to Know Hazardous Substance List: Acetone.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: Acetone.

Pennsylvania - Hazardous Substance List: Acetone.

Rhode Island - Hazardous Substance List: Acetone.

Texas - Hazardous Substance List: Acetone.

West Virginia - Hazardous Substance List: Acetone.

Wisconsin - Toxic and Hazardous Substances: Acetone.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Acetone is not on the California Proposition 65 List.

LABELING: **WARNING!** FLAMMABLE LIQUID AND VAPOR. PROLONGED OR REPEATED SKIN CONTACT MAY DRY SKIN AND CAUSE IRRITATION. HARMFUL OR FATAL IF SWALLOWED. CAN CAUSE CENTRAL NERVOUS SYSTEM EFFECTS OR LIVER DAMAGE. CAN CAUSE DEATH IF TOO MUCH VAPOR IS BREATHED. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation. Avoid contact with skin and clothing. Avoid exposure to vapor. Wash thoroughly after handling. **FIRST-AID:** In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if irritation develops or persists. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, do not induce vomiting. Get medical attention. **IN CASE OF FIRE:** Use water fog, foam, dry chemical, or CO₂. **IN CASE OF SPILL:** Absorb spill with inert materials (e.g. activated carbon, dry sand). Flush residual spill with water. Consult Material Safety Data Sheet for additional information.

ADDITIONAL CANADIAN REGULATIONS:

OTHER CANADIAN REGULATIONS: Not applicable.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: Acetone is not on the CEPA Priorities Substances Lists.

CANADIAN DSL/NDL INVENTORY STATUS: Acetone is listed on the Canadian DSL Inventory.

CANADIAN WHMIS SYMBOLS:

Class B2: Flammable Liquid

Class D2B: Materials Causing Other Toxic Effects



16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS # - This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits.

TLV - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour **Time Weighted Average (TWA)**, the 15-minute **Short Term Exposure Limit**, and the instantaneous **Ceiling Level**. Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration

PEL - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA.

The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (*Federal Register* 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury.

The DFG - MAK is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (OSHA). NIOSH issues exposure guidelines called **Recommended Exposure Levels (RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health

Hazard: 0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids, liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: 0 (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); 2 (materials that are unstable but do not detonate or which can react violently with water); 3 (materials that can detonate when initiated or which can react explosively with water); 4 (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard:

0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure could cause serious temporary or residual injury); 4 (materials that under very short exposure could cause death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR

Much of the information related to fire and explosion is derived from the **National Fire Protection Association (NFPA)**. Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature: The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** concentration expressed in parts of material per million parts of air or water; **mg/m³** concentration expressed in weight of substance per volume of air; **mg/kg** quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program; **RTECS** - the Registry of Toxic Effects of Chemical Substances. **OSHA** and **CAL/OSHA**, **IARC** and **NTP** rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo**, the lowest concentration to cause a symptom; **TD₀₁**, **LDLo**, and **LD₀₁** or **TC**, **TC₀₁**, **LCLo**, and **LC₀₁**, the lowest dose (or concentration) to cause death. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

REGULATORY INFORMATION:

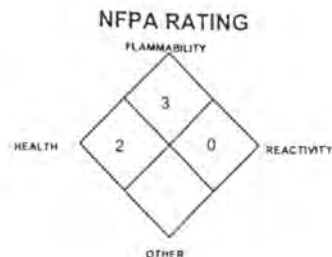
This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. **Superfund Amendments and Reauthorization Act (SARA)**; the **Canadian Domestic Substances List (DSL)**; the U.S. **Toxic Substances Control Act (TSCA)**; Marine Pollutant status according to the **DOT**; California's Safe Drinking Water Act (**Proposition 65**); the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund)**; and various state regulations. This section also includes information on the precautionary warnings which appear on the materials package label.



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS

Standards



PART I What is the material and what do I need to know in an emergency?

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

TOLUENE

C₇H₈

Document Number: 1063

PRODUCT USE:

For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME:

AIRGAS INC.

ADDRESS:

259 Radnor-Chester Road
Suite 100
Radnor, PA 19087-5240

BUSINESS PHONE:

1-610-687-5253

EMERGENCY PHONE:

CHEMTREC: 1-800-424-9300

DATE OF PREPARATION:

May 14, 1997

DATE OF FIRST REVISION:

December 16, 1997

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH ppm	OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm		
Toluene	108-88-3	99.9%	50, Skin	NE	200	300, C 500, 10 min peak per 8 hour shift	500	NIOSH RELs: TWA: 100 ppm STEL: 150 ppm DFG MAKs: 50 ppm Carcinogen: EPA-D IARC-3
			A4, Not Classifiable as a Human Carcinogen		100 (Vacated 1989 PEL)	150 (Vacated 1989 PEL)		

NE = Not Established C = Ceiling Limit See Section 16 for Definitions of Terms Used.

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Toluene is a colorless, flammable, toxic liquid, with gasoline-like odor. Inhalation of vapors of Toluene can affect the central nervous system. Symptoms of central nervous system overexposure can include headache, drowsiness, dizziness, fatigue, nausea and weakness. Skin and eye contact can be irritating. This liquid is very flammable; vapors are heavier than air and may travel long distances to source of ignition and flashback. If involved in a fire Toluene will decompose to produce toxic gases (e.g., carbon monoxide, carbon dioxide, reactive hydrocarbons and aldehydes). Toluene is not reactive under normal circumstances. Persons responding to releases of this product must have adequate fire protection for the specific emergency situation.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:

The most significant routes of occupational overexposure for Toluene are by inhalation, and contact with skin or eyes. The following paragraphs describe symptoms of exposure by route of exposure.

INHALATION: Exposures to high concentrations of vapors of Toluene can cause central nervous system effects. Symptoms of central nervous system effects are related to exposure concentrations. The effects associated with various levels of Toluene vapors are as follows:

CONCENTRATION

~50 ppm:

50-100 ppm:

Above 100 ppm:

Over 200 ppm:

Over 500 ppm:

10,000 ppm (est)

SYMPTOMS OF EXPOSURE

Slight drowsiness and headache.

Irritation of the nose, throat and respiratory tract.

Fatigue and dizziness.

Symptoms similar to drunkenness, giddiness, numbness, and mild nausea.

Mental confusion and incoordination, loss of appetite, a bad taste.

At this concentration Toluene causes visual disturbances and further depression of the central nervous system which can result in unconsciousness and death.



In an industrial setting, the most serious overexposures have occurred when vapors of Toluene have accumulated in small, confined spaces or other poorly-ventilated areas. Liver and kidney damage as well as disturbances to the heart have been reported from overexposure to vapors of Toluene, in cases of sniffing abuse of glues. Sniffing of glues containing Toluene can lead to the three sets of symptoms, as described below:

- Severe muscle weakness leading to limb paralysis, associated with hypokalemia (deficiency of potassium in the blood) due to renal tubular acidosis. Cardiac arrhythmias often accompany the hypokalemia.
- Gastrointestinal complaints, including abdominal pain, nausea, vomiting, and hematemesis (vomiting of blood).
- Neuropsychiatric complaints including:
 - a) lethargy, hallucinations, coma, or
 - b) headache, dizziness, syncope (loss of consciousness due to sudden lack of blood supply to brain), or
 - c) paresthesias (morbid sensations) and peripheral neuropathy (tingling in the extremities), or
 - d) cerebellar ataxia (incoordination of voluntary muscular movements) and other cerebellar signs.

The symptoms described above may potentially occur after long-term inhalation overexposures to Toluene in occupational settings, as well as inhalation of fumes from glues.

CONTACT WITH SKIN or EYES: Initial contact with the skin can cause mild irritation. Prolonged contact can result in a burning sensation and reddening of the skin. Toluene is a defatting agent, removing oils from the skin and causing red cracked and dry skin. Prolonged or repeated contact with the skin will cause dermatitis. Very short exposure (3-5 minutes) to the eyes of vapors of Toluene at a concentration of 300 ppm causes slight irritation. Longer exposures (6-7 hours) to levels above 100 ppm will cause irritation. Contact of the liquid the eyes will be irritating, but will not cause permanent damage.

SKIN ABSORPTION: Toluene can be somewhat absorbed through the skin, which may result in irritation at the site of absorption. Symptoms similar to those described for "Inhalation" may also occur, especially in cases of severe overexposure.

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		(BLUE)	2
FLAMMABILITY		(RED)	3
REACTIVITY		(YELLOW)	0
PROTECTIVE EQUIPMENT			C
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8

For routine industrial applications

See Section 16 for Definition of Ratings

3. HAZARD IDENTIFICATION (Continued)

INGESTION: Toluene is readily absorbed by the tissues of the digestive system, producing symptoms of central nervous system depression similar to those described in "Inhalation". If ingested, Toluene presents a potential aspiration hazard. The aspiration of Toluene into the lungs can result in severe lung irritation, leading to lung damage; death may result.

INJECTION: Injection is not anticipated to be a significant route of overexposure for Toluene. If Toluene is "injected" (as may occur through punctures by contaminated, sharp objects), symptoms described in "Inhalation" can occur.

OTHER HEALTH EFFECTS: Toluene poisoning can lead to anemia and leukopenia (deficiency of blood corpuscle which protects against disease), which, upon biopsy, has shown bone marrow hypoplasia (failure of new bone marrow to mature). Exposure to other solvents (such as benzene and ethanol) slows the rate of clearance from the body, enhancing the toxicity of Toluene. For further information, see Section 11, Toxicological Information. In rare cases, repeated overexposure to very high concentrations of Toluene has led to enlargement of the liver.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure to may cause the health effects described below.

ACUTE: Acute inhalation overexposure to Toluene will initially act as a narcotic, possibly leading to coma in extreme cases. Following exposure to high concentrations, victims may be unconscious, and if exposure continues, death can follow from respiratory failure. Contact with the skin can cause irritation and dermatitis. Contact with the eyes is irritating, causing burning and watering of the eyes. Ingestion of Toluene will cause gastric distress and possible severe depression of the central nervous system. Aspiration of Toluene into the lungs, following ingestion can result in severe damage to the lungs; death may result.

CHRONIC: In rare cases, chronic poisoning has led to anemia and other problems with the blood and bone marrow. Chronic Toluene overexposure may also result in a variety of health problems (e.g., headaches, fatigue, loss of coordination, memory loss, and optic nerve disorders). See Section 11 (Toxicology Information) for additional data.

TARGET ORGANS: Respiratory system, central nervous systems, heart, kidneys, bone marrow, skin, eyes, reproductive system, and liver.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO TOLUENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. If necessary, a Self-Contained Breathing Apparatus should be worn.

INHALATION: If vapors, mists, or sprays of Toluene are inhaled, remove victim to fresh air. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Remove or cover gross contamination to avoid exposure to rescuers.

SKIN EXPOSURE: If Toluene contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek medical attention if any adverse reaction occurs.

EYE EXPOSURE: If Toluene or its vapors enter the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention.

INGESTION: If Toluene is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, do not induce vomiting. Victim should drink milk, egg whites, or large quantities of water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow.

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Physicians should refer to "Recommendations to Physicians" in Section 11 (Toxicological Information). Take copy of label and MSDS to health professional with victim.

5. FIRE-FIGHTING MEASURES

FLASH POINT, (Closed Cup): 4.4°C (40°F)

AUTOIGNITION TEMPERATURE: 480°C (896°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 1.2%

Upper (UEL): 7.1%

5. FIRE-FIGHTING MEASURES (Continued)

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES (for cooling only)

Foam: YES

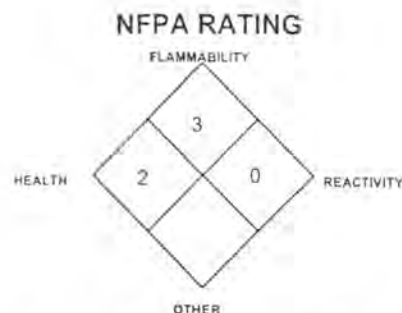
Halon: YES

Carbon Dioxide: YES

Dry Chemical: YES

Other: Any "B" Class.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Toluene is a Class IB flammable liquid and presents a serious fire hazard to firefighters. When involved in a fire, this material ignites and produces toxic gases (e.g., carbon monoxide, carbon dioxide, reactive hydrocarbons and aldehydes). The vapors of Toluene are heavier than air and may spread long distances; distant ignition and flash-back are possible. Toluene can float on water; therefore, water contaminated with this product can spread the flammable liquid and can spread fire. Containers of Toluene, when involved in fire, may rupture or burst in the heat of the fire.



See Section 16 for Definition of Ratings

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Toluene can accumulate static charge by flow or agitation; vapors can be ignited by static discharge.

SPECIAL FIRE-FIGHTING PROCEDURES: Eliminate sources of ignition. In the event of fire, cool containers of this product with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Water may not be effective in actually extinguishing a fire involving Toluene, due to its low flash point. Stop the leak or discharge, if possible. For small releases, if it is not possible to stop the leak, and it does not endanger personnel, let the fire burn itself out. Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. Large fires should be fought from a distance with an unmanned hose holder or monitor nozzles. If Toluene is involved in a fire, fire run-off water should be contained to prevent possible environmental damage. If necessary, decontaminate fire-response equipment with soap and water solution. For large releases, consider evacuation. Refer to the North American Emergency Response Guidebook (Guide #130) for additional guidance.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

Minimum Personal Protective Equipment should be **Level B: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), chemically resistant suit and boots, hard-hat, and Self-Contained Breathing Apparatus**. Monitor the surrounding area for combustible vapor levels. Combustible vapor levels must be below 10% of the LEL for Toluene (LEL = 1.2%) before personnel are permitted to enter the area. If necessary, ventilate area.

Monitoring should be done for the levels of Toluene and oxygen. Colorimetric tubes are available to detect the presence of Toluene. Levels of Toluene should be below levels listed in Section 2 (Composition and Information on Ingredients) and the atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

Eliminate all sources of ignition before clean-up operations begin. Use non-sparking tools. Absorb spilled liquid with activated carbon, polypads or other suitable absorbent materials. Prevent material from entering sewer or confined spaces. Decontaminate the area thoroughly. Place all spill residue in an appropriate container and seal. If necessary, decontaminate spill-response equipment with soap and water solution. Dispose of in accordance with Federal, State, and local hazardous waste disposal regulations (see Section 13, Disposal Considerations).

THIS IS A TOXIC, FLAMMABLE LIQUID: Protection of all personnel and the area must be maintained. All responders must be adequately protected from exposure.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Toluene ON YOU or IN YOU. Wash thoroughly after chemicals. Do not eat, drink, smoke or apply cosmetics while handling this material. Remove contaminated clothing immediately.

7. HANDLING and STORAGE (Continued)

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Avoid breathing vapors or mists generated by this product. Use in a well-ventilated location. Cylinders of this product must be properly labeled. If this product is used in other types of containers, only use portable containers and dispensing equipment (faucet, pump, drip can) approved for flammable liquids. Post "NO SMOKING" signs, where appropriate in storage and use areas.

Store cylinders of this product in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Do not allow area where cylinders are stored to exceed 52°C (125°F). Material should be stored in secondary containers, or in a diked area, as appropriate. Store containers away from incompatible chemicals. Keep container tightly closed when not in use. Storage areas should be made of fire-resistant materials. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged.

Empty containers may contain residual flammable liquid or vapors. Therefore, empty containers should be handled with care. Do not expose "empty" containers to welding touches, or any other source of ignition.

SPECIAL PRECAUTIONS FOR HANDLING CYLINDERS: Protect cylinders of this product against physical damage. If appropriate, cylinders should be stored in an up-right position. Cylinders should be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used:

Before Use: If appropriate, move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with this product. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Bulletin SB-2 "Oxygen Deficient Atmospheres".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely, if necessary. Decontaminate equipment using soapy water before maintenance begins. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Use a mechanical fan or vent area to outside. Where appropriate, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Ensure eyewash/safety shower stations are available near areas where this product is used.

RESPIRATORY PROTECTION: Maintain exposure levels of Toluene below the levels listed in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if Toluene levels exceed exposure limits and if oxygen level is below 19.5% or during emergency response to a release of this product. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards. The NIOSH respiratory protection recommendations for Toluene are presented on the following page.

CONCENTRATION

Up to 500 ppm:

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive-pressure, full facepiece SCBA or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

Escape: Gas mask with organic vapor cartridge or escape-type SCBA should be used.

NOTE: The IDLH concentration for Toluene is 500 ppm.

RESPIRATORY EQUIPMENT

Chemical cartridge respirator with organic vapor cartridges; or gas mask with organic vapor canister, or powered, air-purifying respirator with organic vapor cartridges, or Supplied Air Respirator (SAR), or full-facepiece SCBA.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION (Continued)

EYE PROTECTION: Splash goggles or safety glasses. Face-shields should be worn if contact with the liquid is anticipated.

HAND PROTECTION: Wear leather gloves for handling of cylinders of Toluene. Wear chemically resistant gloves appropriate for Toluene for industrial use. Gloves should have a resistance to breakthrough greater than 8 hours, such as Teflon™ or Viton™. Butyl rubber, natural rubber, neoprene, nitrile rubber, or polyethylene are not recommended. Use triple gloves for spill response (see Section 6, Accidental Release Measures).

BODY PROTECTION: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product. Safety shoes are recommended when handling cylinders.

9. PHYSICAL and CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): 3.1

SPECIFIC GRAVITY @ 20°C (68°F) (water = 1): 0.86

SOLUBILITY IN WATER @ 25°C (77°F): 54-58 mg/100 mL

EVAPORATION RATE: 2.24

EXPANSION RATIO: Not applicable.

LOG COEFFICIENT WATER/OIL DISTRIBUTION: Log P (oct) = 2.11-2.80

VAPOR PRESSURE @ 20°F (68°F) 22 mm Hg: 2.93 kPa

pH: Not applicable.

FREEZING/MELTING POINT: -95°C (-139°F)

BOILING POINT: 110.6°C (231.1°F)

ODOR THRESHOLD: Not available.

SPECIFIC VOLUME: Not applicable.

APPEARANCE AND COLOR: Colorless, flammable liquid, with a strong, gasoline-like odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor of Toluene is not a good warning property as it has a variation of odor threshold values. The smell of Toluene may not be noticed after short exposure.

10. STABILITY and REACTIVITY

STABILITY: Normally stable.

DECOMPOSITION PRODUCTS: If Toluene is involved in a fire, it may ignite to yield toxic fumes of carbon monoxide, carbon dioxide, reactive hydrocarbons and aldehydes.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Toluene is incompatible with strong oxidizers, which increase the risk of fire and explosion. Toluene reacts violently to nitric acid and sulfur dichloride. When combined with sulfuric acid, an exothermic reaction will occur. Toluene will react vigorously with uranium hexafluoride. When mixed with silver perchlorate Toluene forms explosive complexes and with tetranitromethane Toluene forms a sensitive, highly explosive mixture.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid contact with incompatible materials, sparks, flame static discharge and other sources of ignition. Avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture or burst.

PART III *How can I prevent hazardous situations from occurring?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is available for Toluene.

Eye effects-Human 300 ppm

Skin-Rabbit, adult 435 mg Mild irritation effects

Skin-Rabbit, adult 500 Moderate irritation effects

Eye effects-Rabbit, adult 870 µg Mild irritation effects

Eye effects-Rabbit, adult 2 mg/24 hours Severe irritation effects

Eye effects-Rabbit, adult 100 mg/30S ms Mild irritation effects

oms-grasshopper-Inhalation 562 mg/L

Cytogenetic Analysis-Rat-Subcutaneous 12 g/kg/12 days-
Intermittent

Inhalation-Mouse TCLo 400 ppm/7 hours (female 7-16 days post);
Reproductive effects

Oral-Mouse TDLo: 9 g/kg (female 6-15 days post): Teratogenic
effects

Oral-Human LDLo 50 mg/kg

Inhalation-Human TCLo: 200 ppm: BRN, Central nervous system effects,
Blood effects

Inhalation-Man TCLo: 100 ppm: Central nervous system effects

Oral-Rat LD50: 5000 mg/kg

Inhalation-Rat LCLo: 4000 ppm/4 hours

Intraperitoneal-Rat LD50: 1332 mg/kg

Intravenous-Rat LD50: 1960 mg/kg

Unreported-Rat LD50: 6900 mg/kg

Inhalation-Mouse LC50: 400 ppm/24 hours

Intraperitoneal-Mouse LD50: 59 mg/kg

Subcutaneous-Mouse LD50: 2250 mg/kg

Unreported-Mouse LD50: 2 g/kg

Intraperitoneal-Mouse LD50: 640 mg/kg

Inhalation-Rabbit, adult LCLo: 55,000 ppm/40 minutes

Skin-Rabbit, adult LD50: 12,124 mg/kg

11. TOXICOLOGICAL INFORMATION (Continued)

SUSPECTED CANCER AGENT: Toluene is listed as follows:

ACGIH-A4 (Not Classifiable as a Human Carcinogen)

EPA-D (Not Classifiable as to Human Carcinogenicity)

IARC-3 (Not Classifiable as to Human Carcinogenicity).

Toluene is not found on the following lists: NTP, OSHA, CAL/OSHA; therefore is not considered to be, nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Toluene is mildly irritating to the skin, eyes, and other contaminated tissue.

SENSITIZATION OF PRODUCT: Toluene is not known to cause respiratory system or skin sensitization in humans. Cardiac sensitization to stimulants (e.g., epinephrine, ephedrine) is a possible result of severe or chronic overexposure.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Toluene on the human reproductive system.

Mutagenicity: Toluene was not mutagenic in most of the numerous in vivo and in vitro tests. There is some evidence that it can cause chromosome damage in vivo when administered to mice by injection, although conflicting results have been obtained.

Embryotoxicity: Toluene is not reported to cause embryotoxic effects in humans. However, there is some evidence of embryotoxic effects in animals during clinical studies. Refer to "Teratogenicity" for additional information.

Teratogenicity: Toluene is not reported to cause teratogenic effects in humans. Many studies have been conducted on rats, mice, and rabbits (primarily through inhalation exposure). Toluene did not cause birth defects, but exposures of pregnant rats to concentrations greater than 500 ppm resulted in fetotoxicity effects (e.g., reduced birth weights, delay in bone formation).

Reproductive Toxicity: Data on reproductive effects are available from clinical studies involving test animals exposed to relatively high doses of Toluene.

*A **mutagen** is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An **embryotoxin** is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance which interferes in any way with the reproductive process.*

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions, central nervous system, liver, kidney, and cardio-vascular conditions may be aggravated by severe or chronic overexposure to this product. Skin disorders may also be aggravated by exposures to Toluene.

RECOMMENDATIONS TO PHYSICIANS: The following guidelines are derived from "Clinical Toxicology of Commercial Chemical Products" (5th edition, 1984).

- Check for signs of impending pulmonary edema.
- Because of the aspiration hazard, avoid emetic drugs, whenever practical.
- For ingestion overexposures in which Toluene contains another toxic component and induction of emesis is advisable: If the patient is not drowsy, comatose, or in respiratory difficulty, induce vomiting. If necessary, as an alternative treatment, remove Toluene from the stomach via gastric lavage. One or two ounces of mineral oil may be instilled and left in the stomach at the completion of lavage.
- Avoid epinephrine because of its possible adverse effect on the sensitized myocardium. Avoid all digestible fats, oils and alcohol, which may promote the absorption of Toluene in the intestinal system.
- If eyes or skin are affected, wash thoroughly and apply a bland analgetic ointment.
- Because of the possibility of ventricular fibrillation, monitor the ECG continuously and be prepared to administer external cardiac massage.
- In chronic solvent abusers, correct dehydration, acidosis, hypokalemia and hypophosphatemia. Usually toxic signs and symptoms (except those due to neuropathies and to cerebellar lesions) disappear within a few days after fluid and electrolyte abnormalities are corrected.

BIOLOGICAL EXPOSURE INDICES (BEIs): The following Biological Exposure Indices (BEIs) are currently applicable for Toluene.

CHEMICAL DETERMINANT	SAMPLING TIME	BEI
TOLUENE • Hippuric acid in urine • Toluene in venous blood • Toluene in end-exhaled air	• End of shift • Last 4 hours of shift • End of shift	• 2.5 g/g creatinine • 1 mg/L • Refer to current TLV list.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Toluene will be degraded over time into other organic compounds. The following environmental data are available for Toluene.

TOLUENE: $K_{oc} = 2.73$. Water Solubility = 534 mg/L. Biological Half-Life = 0.083 days. Bioconcentration Factors = 13.2 (eels, *Anguilla japonica*); 1.67 (Manila clam (*Tapes semidecussata*); 4.2 (mussel, *Mytilus edulis*); 380 (algae, *Chorella fusca*); 90 (golden ide fish). Toluene is rapidly volatilized from water and undergoes moderate biodegradation. The half-life in water is on the order of days to weeks.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Toluene may be harmful or fatal to contaminated plant and animal-life (especially if large quantities of Toluene are released). Refer to Section 11 (Toxicology Information) for information on test animals. The following information is available for Toluene's effects on plant-life.

STUDY # 1: Suspensions of sunflower leaves were prepared from 3-5 week old plants. Two ml of toluene was applied to 5 grams of the fresh sunflower leaves. The rate of electrolyte loss caused by this treatment was 435 (min $-1 \times E-4$), while the rate of electrolyte loss in the control groups ranged from 16-21 (min $-1 \times E-4$).

STUDY # 2: Three tomatoes, 20 carrots, and 12 barley seedlings were tested 32, 32, and 14 days after planting. Plants were exposed to 6.4, 12.0, or 24.1 mg/l Toluene for 1/4, 1/2, 1, and 2 hours. Toluene was observed to be toxic at concentrations of 6.4 to 12.0 mg/l after 15 minutes of exposure. Fifteen minutes of exposure at 12 mg/l toluene produced 50, 0, and 60% injury to tomato, carrot, and barley, respectively. For lethality to occur at 12.0 mg/l, barley required 1 hour, tomato 2 hours, and carrot over 2 hours. At 6.4 mg/l toluene, percentage of injury to barley after a 2-hour exposure was reduced from 100% to 15% (lethal). Toluene entered the plant rapidly through the cuticle and stomata. Symptoms of injury included a darkening of the tips of the youngest leaves. This darkening spread to the older leaves. There was a loss of turgor, with drooping stems and leaves. In bright sunlight, chlorophyll was destroyed.

STUDY # 3: Toluene was mixed with Lakeland sand or Davidson soil at rates of 0 ppm, 200 ppm, 2,000 ppm, and 20,000 ppm. The soils were immediately planted with 4 corn, 6 soybean, and fescue seed. Plants harvested at the end of 3 weeks. A 10% yield reduction on the Lakeland soil was evident at 200 ppm for corn, 800 ppm in soybean and 2,000 ppm in fescue. At 2,000 ppm or more, there was at least 50% or more reduction in the fresh weight of all three crops. There were no visible symptoms of toluene toxicity above the critical levels. The critical phytotoxic limit on Lakeland sand was 200 to 2,000 ppm of toluene while on the Davidson soil the was 2,000 to 20,000 ppm toluene.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Toluene can be harmful or fatal to contaminated aquatic plant and animal life. Toluene floats on water, and can potentially form slicks which are capable of creating oxygen-deprived waterways which can contaminate coastal and shore life. The following aquatic toxicity data are available for Toluene.

EC₅₀ (*Pimephales promelas*, fathead minnow - embryos/larvae/minnows) = 55-72 mg/L/25-36 mg/L/26-31 mg/L - 96 hours. Effect - loss of equilibrium.
LC₅₀ (*Pimephales promelas*, fathead minnow) = 36.2 mg/L/96 hours
LC₅₀ (Bluegill) = 17 mg/L/24 hours; 13 mg/L/96 hours; 21-23 °C
LC₅₀ (*Palaemonetes pugio*, grass shrimp) = 9.5 ppm/96 hours
LC₅₀ (*Cancer magister*, crab larvae) = 28 ppm/96 hours
LC₅₀ (*Crangon franciscorum*, shrimp) = 4.3 ppm 96 hours
TLm (fathead minnow) = 56-34 mg/L, 24-96 hours
TLm (*Lebistes reticulatus*, guppy) = 63-59 mg/L, 24-96 hours
LC₅₀ (Channel Catfish) = 240 mg/L

LC₅₀ (*Pimephales promelas*, fathead minnow) = 534.27 mg/L; 96 hours
LC₅₀ (*Carassium auratus*, goldfish) = 57.68 mg/L; 96 hours
LC₅₀ (*Lebistes reticulatus*, guppy) = 59.30 mg/L; 96 hours
LC₅₀ (*Daphnia magna*, water flea) = 313 mg/L; 48 hours
LC₅₀ (*nitocra spinipes*, copepod) = 24.2-74.2 mg/L; 24 hours
LC₅₀ (*Artemia salina*, Brine Shrimp) = 33 mg/L; 24 hours
LC₅₀ (*Morone saxatilis*, striped bass) = 7.3 mg/L; 96 hours
LC₅₀ (sheephead minnow) = 277-485 mg/L; 96 hours
LC₅₀ (*Aedes aegypti*) 22 mg/L
LC₅₀ (*Alandria granaria*, grain weevil) = 210 mg/L

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with residual product to Airgas Inc. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:	Toluene
HAZARD CLASS NUMBER and DESCRIPTION:	3 (Flammable Liquid)
UN IDENTIFICATION NUMBER:	UN 1294
PACKING GROUP:	PG II
DOT LABEL(S) REQUIRED:	Flammable Liquid
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996):	130

MARINE POLLUTANT: Toluene is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information, in addition to the following:

HAZARD CLASS NUMBER, DESCRIPTION:	3 (Flammable Liquid), 9.2 (Hazardous to the Environment)
SPECIAL PROVISION:	109
REGULATED LIMIT:	50 kg

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Toluene is subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
TOLUENE	NO	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): 1000 lb.

CANADIAN DSL/NDL INVENTORY STATUS: Toluene is listed on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Toluene is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Toluene is a toxic pollutant under Section 307(a)(1) of the Clean Water Act and is subject to effluent limitations. Toluene is not listed in Appendix A as a highly hazardous chemical, per 29 CFR 1910.119: Process Safety Management of Highly Hazardous Chemicals. Under this regulation, however, any process that involves a flammable liquid on-site, in one location, in quantities of 10,000 lb. (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

U.S. STATE REGULATORY INFORMATION: Toluene is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Toluene	Minnesota - List of Hazardous Substances: Toluene	Pennsylvania - Hazardous Substance List: Toluene
California - Permissible Exposure Limits for Chemical Contaminants: Toluene.	Missouri - Employer Information/Toxic Substance List: Toluene.	Rhode Island - Hazardous Substance List: Toluene.
Florida - Substance List: Toluene.	New Jersey - Right to Know Hazardous Substance List: Toluene	Texas - Hazardous Substance List: Toluene.
Illinois - Toxic Substance List: Toluene.	North Dakota - List of Hazardous Chemicals, Reportable Quantities: Toluene	West Virginia - Hazardous Substance List: Toluene.
Kansas - Section 302/313 List: Toluene.		Wisconsin - Toxic and Hazardous Substances: Toluene
Massachusetts - Substance List: Toluene.		
Michigan Critical Materials Register: Toluene		

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Toluene is listed on the California Proposition 65 Lists. **WARNING:** Toluene is known to the State of California to cause birth defects or other reproductive harm.

LABELING: WARNING! FLAMMABLE LIQUID AND VAPOR. FLASH POINT = 4.4°C (40°F). HARMFUL IF INHALED. PROLONGED OR REPEATED SKIN CONTACT MAY DRY SKIN AND CAUSE IRRITATION. CAN CAUSE CENTRAL NERVOUS SYSTEM EFFECTS. CAN CAUSE ADVERSE EFFECTS ON THE BLOOD SYSTEM. LIVER, KIDNEYS. MAY CAUSE REPRODUCTIVE EFFECTS, BASED ON ANIMAL TESTS. CAN CAUSE DEATH IF TOO MUCH IS BREATHED. ASPIRATION HAZARD IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation. Avoid contact with skin and clothing. Avoid exposure to vapor. Wash thoroughly after handling. **FIRST-AID:** In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if irritation develops or persists. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of fire, use water fog, foam, dry chemical, or CO₂. In case of spill: Absorb spill with inert materials (e.g. activated carbon, dry sand). Flush residual spill with water. Consult Material Safety Data Sheet for additional information.

CANADIAN WHMIS SYMBOLS:

Class B2: Flammable Liquid

Class D2A/D2B: Material Causing Other Toxic Effects



16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (TWA), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (C). Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. **The DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (OSHA). NIOSH issues exposure guidelines called Recommended Exposure Levels (RELs). When no exposure guidelines are established, an entry of NE is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard: 0 (minimal acute or chronic exposure hazard); 1 (slight acute or chronic exposure hazard); 2 (moderate acute or significant chronic exposure hazard); 3 (severe acute exposure hazard, onetime overexposure can result in permanent injury and may be fatal); 4 (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: 0 (minimal hazard); 1 (materials that require substantial pre-heating before burning); 2 (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); 3 (Class IB and IC flammable liquids with flash points below 38°C [100°F]); 4 (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: 0 (normally stable); 1 (material that can become unstable at elevated temperatures or which can react slightly with water); 2 (materials that are unstable but do not detonate or which can react violently with water); 3 (materials that can detonate when initiated or which can react explosively with water); 4 (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: 0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); 1 (materials that on exposure under fire conditions could cause irritation or minor residual injury); 2 (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); 3 (materials that can on short exposure could cause serious temporary or residual injury); 4 (materials that under very short exposure causes death or major residual injury).

NATIONAL FIRE PROTECTION ASSOCIATION (Continued):

Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (NFPA). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature - The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** - concentration expressed in parts of material per million parts of air or water; **mg/m³** - concentration expressed in weight of substance per volume of air; **mg/kg** - quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program; **RTECS** - the Registry of Toxic Effects of Chemical Substances; **OSHA** and **CAL/OSHA**. IARC and NTP rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo**, the lowest concentration to cause a symptom; **TDo**, **LDLo**, and **LDo**, or **TC**, **TCo**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: **EC** is the effect concentration in water.

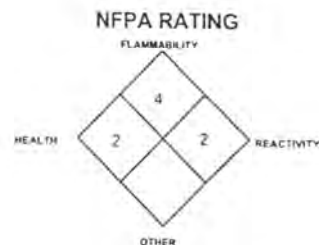
REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (SARA); the Canadian Domestic/Non-Domestic Substances List (DSL/NDL); the U.S. Toxic Substance Control Act (TSCA); Marine Pollutant status according to the DOT; the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund); and various state regulations.



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards



PART I What is the material and what do I need to know in an emergency?

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

VINYL CHLORIDE - CH₂CHCl

Document Number: 001067

PRODUCT USE:

For general analytic/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME:

AIRGAS INC.

ADDRESS:

259 N. Radnor-Chester Road

Suite 100

Radnor, PA 19087-5283

BUSINESS PHONE:

1-610-687-5253

EMERGENCY PHONE:

1-800-949-7937

International: 423-479-0293

DATE OF PREPARATION:

November 20, 1997

REVISION DATE:

January 3, 2001

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		CSHA		IDLH	OTHER
			TLV ppm	STE L ppm	PEL ppm	STEL ppm		
Vinyl Chloride	75-01-4	> 99.9%	5, A1 (Confirmed Human Carcinogen)	NE	1	5, C (15 minutes)	NE	NIOSH: Carcinogen; Reduce exposure to lowest feasible level. Carcinogen: IARC-1; MAK-A1; NTP-1; OSHA-X; NIOSH-X
Maximum Impurities		< 0.1%	None of the trace impurities in this product contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Vinyl Chloride is a colorless, liquefied, toxic, flammable gas with a sweet, ethereal odor. Vinyl Chloride is a known human carcinogen and is toxic by all routes of exposure. Contact with the skin and eyes will result in irritation. Inhalation of Vinyl Chloride may produce symptoms of drowsiness, blurred vision, staggering gait and tingling and numbness in the extremities. Contact with the liquid may result in frostbite. Both the liquid and gas pose a serious fire hazard when accidentally released. Vinyl Chloride polymerizes readily when exposed to air, sunlight, heat or oxygen and so can form dangerous explosive air/gas mixtures. Flame or high temperature impinging on a localized area of the cylinder of Vinyl Chloride can cause the cylinder to rupture without activating the cylinder's relief devices. Provide adequate fire protection during emergency response situations.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:

The most significant routes of overexposure for Vinyl Chloride are by inhalation or skin and eye contact. The following paragraphs describe symptoms of exposure by route of exposure.

INHALATION: Vinyl Chloride acts as a general anesthetic in concentrations over 500 ppm. Overexposure to low levels of Vinyl Chloride will result in dizziness, light-headedness, euphoria, nervousness, drowsiness, headache, blurred vision, impaired hearing and confusion. Acute exposures to 1000 ppm will slowly produce symptoms such as staggering gait and tingling in the hands and feet. Overexposure to extremely high concentrations (greater than 70,000 ppm) of Vinyl Chloride may cause unconsciousness and death, with possible liver, spleen, and kidney damage.

SKIN CONTACT: The gas is mildly irritating to exposed skin. Accidental spraying of the liquid gas may cause burns from freezing, due to rapid evaporation.

EYE CONTACT: Vinyl Chloride gas is mildly irritating to the eyes. Accidental spraying of the liquid into the eye(s) may cause burns from freezing, due to rapid evaporation.



OTHER POTENTIAL HEALTH EFFECTS: Contact with liquid or rapidly expanding gases (which are released under high pressure) may cause frostbite. Symptoms of frostbite include change in skin color to white or grayish-yellow. The pain after such contact can quickly subside.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms: Overexposure to Vinyl Chloride may cause the following health effects:

ACUTE: The most significant hazard associated with Vinyl Chloride is inhalation of vapors, which can produce symptoms of central nervous system depression, such as dizziness, light-headedness, headache, nervousness confusion and impairment of vision and hearing. Overexposure to extremely high concentrations may cause unconsciousness and death, with possible liver, spleen, and kidney damage. Contact with liquid or rapidly expanding gases may cause frostbite.

CHRONIC: Long-term exposure to low levels of Vinyl Chloride causes angiosarcoma of the liver, which is a rare form of liver cancer. Chronic exposure to Vinyl Chloride has been associated with cancers of the brain, lungs and blood-forming and lymphatic systems. In the past, chronic exposure to high levels of Vinyl Chloride has resulted in acro-osteolysis (a type of degenerative bone disease) and reports of increased frequency of chromosomal changes. These symptoms have been reduced significantly due to current stringent handling procedures. Refer to Section 11 (Toxicology Information) of this MSDS for additional information.

TARGET ORGANS: Central nervous system, liver, spleen, kidneys, respiratory system and, potentially, the reproductive system.

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		(BLUE)	2
FLAMMABILITY		(RED)	4
REACTIVITY		(YELLOW)	2
PROTECTIVE EQUIPMENT			X
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For routine industrial applications			

See Section 16 for Definition of Ratings

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO VINYL CHLORIDE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus and Fire-Retardant Personal Protective equipment should be worn. Adequate fire protection must be provided during rescue situations.

Remove victim(s) to fresh air, as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation, if necessary.

SKIN EXPOSURE: Immediately flush affected area with water for at least 15 minutes. Contact with the liquid or rapidly expanding gases can cause frostbite. In the event of frostbite, medical attention must be sought. Frozen tissue is painless and appears waxy, with a possible yellow color. Frozen tissue will become swollen, painful and prone to infection when thawed. If the frozen part of the body has been thawed by the time medical attention has been obtained, cover the area with a dry sterile dressing and a large bulky protective covering.

EYE EXPOSURE: In the event of contact with the eyes, flush the affected eye(s) with running water for at least 15 minutes. Victims of eye exposure should be taken to medical attention immediately.

5. FIRE-FIGHTING MEASURES

FLASH POINT (Open Cup): -77.8°C (-108°F)

AUTOIGNITION TEMPERATURE: 472.0°C (881.6°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 4.0%

Upper (UEL): 22.0%

FIRE EXTINGUISHING MATERIALS: Extinguish Vinyl Chloride fires by shutting off the source of the gas. Water spray should be used to cool fire-exposed containers, structures and equipment. Use carbon dioxide, foam or dry chemicals as extinguishing media, if possible.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Extremely flammable gas. Very dangerous fire hazard when exposed to heat, flame or powerful oxidizers.

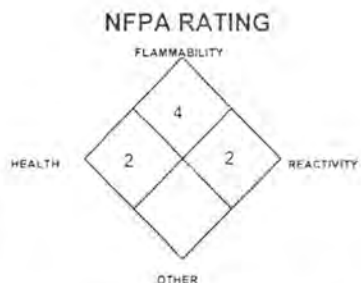
If stored for prolonged periods of time in the absence of sufficient polymerization inhibitor, dangerous peroxide compounds may form by oxidization with atmospheric oxygen in the presence of various contaminants. Contact with metals such as copper, aluminum and certain catalytic impurities can cause violent polymerization. Explosion hazard in confined spaces. During a fire, toxic gases (i.e. hydrogen chloride, carbon dioxide, carbon monoxide, and traces of phosgene) may be produced.

DANGER! Fires impinging (direct flame) on the outside surface of unprotected cylinders of Vinyl Chloride can be very dangerous. Exposure to fire could cause a catastrophic failure of the cylinder releasing the contents into a fireball and explosion of released gas. The resulting fire and explosion can result in severe equipment damage and personnel injury or death over a large area around the cylinder. For massive fires in large areas, use unmanned hose holder or monitor nozzles; if this is not possible, withdraw from area and allow fire to burn.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Static discharge may cause Vinyl Chloride to ignite explosively.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. Because of the potential for a BLEVE, evacuation of non-emergency personnel is essential. If the flow of gas cannot be stopped, it is better to allow the gas to burn rather than form potentially explosive air/gas hazard. If the fire is extinguished before the flow of gas can be stopped, the gas can explosively re-ignite. If water is not available for cooling or protection of cylinder exposures, evacuate the area. Refer to the North American Emergency Response Guidebook (Guide #116P) for additional information.



See Section 16 for Definition of Ratings

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a gas release, clear the affected area, protect people, and respond with trained personnel.

Eliminate any possible sources of ignition, and provide maximum explosion-proof ventilation. If the gas is leaking from cylinder or valve, contact the supplier. Adequate fire protection must be provided. Use only non-sparking tools and equipment during the response.

Minimum Personal Protective Equipment should be **Level B: fire-retardant protective clothing, gloves and Self-Contained Breathing Apparatus**. Use only non-sparking tools and equipment.

Locate and seal the source of the leaking gas. Protect personnel attempting the shut-off with water-spray. Allow the gas to dissipate. Combustible gas concentration must be below 10% of the LEL (4%) prior to entry. Monitor the surrounding area for combustible gas levels and oxygen level. The atmosphere must have levels of Vinyl Chloride below those listed in Section 2 (Information and Composition on Ingredients) and at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus. Attempt to close the main source valve prior to entering the area. If this does not stop the release (or if it is not possible to reach the valve), allow the gas to release in-place or remove it to a safe area and allow the gas to be released there.

THIS IS AN EXTREMELY FLAMMABLE GAS, WHICH IS ALSO TOXIC AND A KNOWN HUMAN CARCINOGEN. Protection of all personnel and the area must be maintained.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting Vinyl Chloride IN YOU. Do not eat or drink while handling chemicals. Be aware of any signs of exposure as indicated in Section 2 (Composition and Information on Ingredients); exposures to fatal concentrations of Vinyl Chloride could occur rapidly.

NOTE: Refer to the OSHA Vinyl Chloride Standard (29 CFR 1910.1017) for specific requirements associated with the use of this gas. The Action Level for Vinyl Chloride is 0.5 ppm. In workplaces where employees are exposed above the Action Level, the OSHA requirements for monitoring, establishment of regulated areas, methods of compliance, respiratory protection, emergency response protocol, medical surveillance, training, and record-keeping must be followed.

STORAGE AND HANDLING PRACTICES: Entrances to regulated areas (as defined by the OSHA Vinyl Chloride Standard) must be posted with legible signs which reads as follows:

CANCER-SUSPECT AGENT AREA
AUTHORIZED PERSONNEL ONLY

Vinyl Chloride should be used in a well-ventilated area, preferably in a hood with forced ventilation. Store in cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight. Do not allow area where cylinders are stored to exceed 52°C (125°F). Cylinders should be separated from oxygen cylinders, or other oxidizers, by a minimum distance of 20 ft., or by a barrier of non-combustible material at least 5 ft. high, having a fire-resistance rating of at least 0.5 hours. Isolate from other incompatible chemicals (refer to Section 10, Stability and Reactivity).

Storage areas must meet national electrical codes for Class 1 Hazardous Areas. Post "No Smoking or Open Flames" signs in storage or use areas. Consider installation of leak detection and alarm for storage and use areas. Have appropriate extinguishing equipment in the storage area (i.e. sprinkler system, portable fire extinguishers). This gas is heavier than air and will accumulate in low areas. Do not store below ground level.

Steel is recommended for all piping, storage tanks and equipment used with Vinyl Chloride. Copper and its alloys and aluminum should never be used in equipment used with Vinyl Chloride due to the potential for violent polymerization with these materials.

Keep the smallest amount on-site as is necessary. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time.

7. HANDLING and STORAGE (Continued)

STORAGE AND HANDLING PRACTICES (continued): Use non-sparking ventilation systems, approved explosion-proof equipment, and appropriate electrical systems. Electrical equipment used in gas-handling operations, or located in storage areas, should be non-sparking or explosion proof. Use a check valve in the discharge line to prevent hazardous backflow. Never tamper with pressure relief devices in valves and cylinders.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: Protect cylinders against physical damage. Use a check valve or trap in the discharge line to prevent hazardous backflow. Cylinders should be stored upright and be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to work situations in which cylinders are being used:

Before Use: Move cylinders with a suitable hand-truck. Do not drag, slide or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap, if provided, in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap, if provided. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with Vinyl Chloride. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Pamphlet P-1, *Safe Handling of Compressed Gases in Containers*. Additionally, refer to CGA Bulletin SB-2 "Oxygen Deficient Atmospheres".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Purge gas handling equipment with inert gas (i.e. nitrogen) before attempting repairs.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. A hood with forced ventilation is preferred, due to the significant toxicity and flammability hazards of Vinyl Chloride. Installation of automatic monitoring equipment to detect the level of Vinyl Chloride and potentially explosive air-gas mixtures is highly recommended.

RESPIRATORY PROTECTION: Maintain exposure levels of Vinyl Chloride below the levels listed in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. During an emergency situation, before entering the area, check for flammable gas level as well as oxygen-deficient atmospheres. Use supplied air respiratory protection if Vinyl Chloride levels exceed exposure limits and if oxygen level is below 19.5% or during emergency response to a release of Vinyl Chloride. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards. The following are NIOSH recommendations for respiratory protection for concentration of Vinyl Chloride in air.

CONCENTRATION

AT ANY DETECTABLE CONCENTRATION:

RESPIRATORY EQUIPMENT

Positive pressure, full-facepiece Self-Contained Breathing Apparatus (SCBA) or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

ESCAPE:

Gas mask with canister to protect against Vinyl Chloride, or escape-type SCBA.

NOTE: Follow the specific respiratory selection guidelines of the OSHA Vinyl Chloride Standard in regulated areas (as defined by 29 CFR 1910.1017).

EYE PROTECTION: Splash goggles or safety glasses and face shield when handling the liquid or gas.

HAND PROTECTION: Wear leather gloves when handling cylinders of Vinyl Chloride. Chemical resistant gloves should be worn when using Vinyl Chloride.

BODY PROTECTION: Use body protection appropriate for task. Chemical resistant material is recommended for protection against contamination with Vinyl Chloride. Safety shoes are recommended when handling cylinders. Response to leaks requires the use of fire retardant clothing. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from gas spraying, as well as fire-retardant items.

9. PHYSICAL and CHEMICAL PROPERTIES

GAS DENSITY @ 21.1°C (70°F) and 1 atm: 0.160 lb/ft³ (2.56 kg/m³)

LIQUID DENSITY @ 21.1°C (70°F) and 1 atm: 56.71 lb/ft³ (908.41 kg/m³)

SPECIFIC GRAVITY @ 15°C (59°F) air = 1: 2.15

EVAPORATION RATE (nBuAc = 1): Not applicable.

FREEZING/MELTING POINT @ 1 atm: -153.9°C (-245°F)

EXPANSION RATIO: Not applicable.

SOLUBILITY IN WATER wt/wt @ 1 atm/25°C (77°F): 0.00114

COEFFICIENT WATER/OIL DISTRIBUTION: Log K_{ow} = 0.6 (calculated).

BOILING POINT @ 1 atm: -13.4°C (7.93°F)

pH: Not applicable.

VAPOR PRESSURE @ 21.1°C (70°F) psig: 35.3

ODOR THRESHOLD: 2000 ppm

SPECIFIC VOLUME (ft³/lb): 6.25

APPEARANCE AND COLOR: Colorless gas with a sweet, ethereal odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor is not a reliable warning property. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation.

10. STABILITY and REACTIVITY

STABILITY: Stable with polymerization inhibitor. Without an inhibitor, storage for prolonged periods of time can form potentially hazardous peroxides by oxidation with atmospheric oxygen in the presence of a variety of contaminants.

DECOMPOSITION PRODUCTS: Decomposition products of Vinyl Chloride include the following toxic gases: carbon monoxide, carbon dioxide and hydrogen chloride gas and trace amounts of phosgene.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Vinyl Chloride is incompatible with strong oxidizers, copper and its alloys, aluminum, certain catalytic impurities, oxides of nitrogen. Vinyl Chloride can react violently with all these materials.

HAZARDOUS POLYMERIZATION: Hazardous polymerization can occur in the presence of air, sunlight or heat. Vinyl Chloride can cause violent polymerization in the presence of strong oxidizers. Vinyl Chloride also polymerizes violently upon contact with copper and its alloys, aluminum and certain catalytic impurities.

CONDITIONS TO AVOID: Contact with incompatible materials and exposure to heat, sparks and other sources of ignition. Cylinders exposed to high temperatures or direct flame can rupture or burst.

PART IV *Is there any other useful information about this material?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is for Vinyl Chloride (gas).

Microsomal Mutagenicity Assay-Salmonella typhimurium 1 pph

Cytogenetic Analysis-Human: HeLa cell 10 mmol/L

Inhalation-Man TCLo: 30 mg/m³ (5 years male); Reproductive effects

Inhalation-Man TCLo: 200 ppm/14 years: Carcinogenic effects;

Oral-Rat TDLo: 1 ppm/4 hours and 3463 mg/kg/52 weeks, intermittent: Carcinogenic effects

Inhalation-Rat TCLo: 10,000 ppm/4 hours (12-18 days preg): Carcinogenic effects, Teratogenic effects

Intraperitoneal-Rat TDLo: 21 mg/kg/65 weeks, intermittent: Equivocal tumorigenic agent

Subcutaneous-Rat TDLo: 21 mg/kg/6765 weeks, intermittent: Equivocal tumorigenic agent

Oral-Rat LD₅₀: 500 mg/kg

Inhalation-Mouse TCLo: 50 ppm/30 weeks: Carcinogenic effects

Inhalation-Hamster TCLo: 50 ppm/4H/30 weeks: Carcinogenic effects

Inhalation-Rat TC: 50 ppm/7H/26 weeks: Carcinogenic effects

Inhalation-Rat TC: 100 ppm/7H/26 weeks: Carcinogenic effects

Inhalation-Mouse TC: 50 ppm/47 weeks I: Carcinogenic effects

Oral-Rat TD: 34 g/kg/3 years, Intermittent: Carcinogenic effects

Inhalation-Mouse TC: 50 ppm/6H/4 weeks: Carcinogenic effects

Inhalation-Mouse TC: 50 ppm/4H/30 weeks: Carcinogenic effects

Inhalation-Rat TC: 250 ppm/2 Years, Intermittent: Carcinogenic effects

Inhalation-Human TC: 300 mg/m³/ weeks: Carcinogenic effects, Blood effects

Inhalation-Rat TC: 5 ppm/4H/52 weeks: Carcinogenic effects

Inhalation Rat TC: 50 ppm/6H-43 weeks: Carcinogenic effects

SUSPECTED CANCER AGENT: Vinyl Chloride is a known human carcinogen, which is listed by the following agencies: IARC-1 (Carcinogenic to Humans); MAK-A1 (Capable of Inducing Malignant Tumors/Human Evidence); NTP-1 (Known to be a Carcinogen); OSHA-X (Carcinogen); ACGIH-A1 (Confirmed Human Carcinogen); NIOSH-X (Carcinogen); Cal-OSHA (Carcinogen).

IRRITANCY OF PRODUCT: Vinyl Chloride can be mildly irritating to eyes and skin. Contact with the liquid or rapidly expanding gases can cause frostbite to exposed tissue.

SENSITIZATION TO THE PRODUCT: Vinyl Chloride is not known to be a sensitizer to humans upon prolonged or repeated contact.

11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Vinyl Chloride on the human reproductive system.

Mutagenicity: Human mutation data are reported for Vinyl Chloride.

Embryotoxicity: There is insufficient evidence currently available to categorize Vinyl Chloride as embryotoxic to humans.

Teratogenicity: There is insufficient evidence currently available to categorize Vinyl Chloride as teratogenic to humans.

Reproductive Toxicity: Vinyl chloride is reported to produce adverse effects on the human reproductive system (i.e. changes in spermatogenesis).

A mutagen is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A reproductive toxin is any substance which interferes in any way with the reproductive process.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Conditions relating to the target organs may be aggravated by overexposures to Vinyl Chloride. See Section 3 (Hazard Identification) for information on these conditions.

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary. Treat symptoms and eliminate exposure. Refer to the OSHA Vinyl Chloride Standard (29 CFR 1910.1017; paragraph K and Appendix A) for specific information on Medical Surveillance requirements (i.e. for the general physical exam, medical history, serum specimens, specific tests, and re-examination protocol).

BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for Vinyl Chloride.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: This gas will be dissipated rapidly in well-ventilated areas. There are limited data indicating the Vinyl Chloride is resistant to biodegradation in aerobic systems. Evaporation half-life from water is 0.45-2.5 hours.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: This gas can be harmful to animal life. Suspected toxic effects on a variety of test animals during clinical studies indicate adverse effects on the central nervous system and liver. Plants may be damaged by frost produced in the presence of rapidly expanding gases. Additional data on the effects of Vinyl Chloride on plants are available as follows:

Increased production of hydrogen peroxide in germinating seeds exposed to Vinyl Chloride gas decreased their sulfhydryl content and thereby produced adverse effects and abnormalities in growth. Threshold levels of Vinyl Chloride were greater than 200 ppm and saturation level was 1000 ppm.

EFFECT OF CHEMICAL ON AQUATIC LIFE: The effect of Vinyl Chloride effects on aquatic life is not fully known. The following data are available for Vinyl Chloride.

Estimated Bioconcentration Factor of 7. Reported water solubility of 2,700 mg/L. Based on the BCF, Vinyl Chloride is not expected to significantly bioconcentrate in aquatic organisms.

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, and local regulations. Return cylinders with residual product to Airgas. Do not dispose locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME:

Vinyl chloride, inhibited

HAZARD CLASS NUMBER and DESCRIPTION:

2.1 (Flammable Gas)

UN IDENTIFICATION NUMBER:

UN 1086

PACKING GROUP:

Not Applicable

DOT LABEL(S) REQUIRED:

Flammable Gas (Note: Per the requirements of the OSHA Vinyl Chloride Standard, 29 CFR 1910.1017, the additional legend "Cancer-Suspect Agent" must be applied near the label or placard).

11. TOXICOLOGICAL INFORMATION (Continued)

NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 116P

MARINE POLLUTANT: Vinyl Chloride is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments.

15. REGULATORY INFORMATION

SARA REPORTING REQUIREMENTS: Vinyl Chloride is subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPONENT	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Vinyl Chloride	NO	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Vinyl Chloride = 1 lb.

CANADIAN DSL INVENTORY: Vinyl Chloride is listed on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Vinyl Chloride is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Vinyl Chloride is regulated under 28 CFR 1910.1017 (OSHA Vinyl Chloride Standard). Vinyl Chloride is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 pounds. Depending on specific operations involving the use of Vinyl Chloride, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Under this regulation Vinyl Chloride is listed in Appendix A of this Standard and the threshold quantity for Vinyl Chloride is 15,000 pounds.

U.S. STATE REGULATORY INFORMATION: Vinyl Chloride is covered under specific State regulations, as denoted below:

Alaska - Designated Toxic and Hazardous Substances: Vinyl Chloride.	Michigan - Critical Materials Register: Vinyl Chloride.	Pennsylvania - Hazardous Substance List: Vinyl Chloride.
California - Permissible Exposure Limits for Chemical Contaminants: Vinyl Chloride.	Minnesota - List of Hazardous Substances: Vinyl Chloride.	Rhode Island - Hazardous Substance List: Vinyl Chloride.
Florida - Substance List: Vinyl Chloride.	Missouri - Employer Information/Toxic Substance List: Vinyl Chloride.	Texas - Hazardous Substance List: Vinyl Chloride.
Illinois - Toxic Substance List: Vinyl Chloride.	New Jersey - Right to Know Hazardous Substance List: Vinyl Chloride.	West Virginia - Hazardous Substance List: Vinyl Chloride.
Kansas - Section 302/313 List: Methyl Chloride.	North Dakota - List of Hazardous Chemicals, Reportable Quantities: Vinyl Chloride.	Wisconsin - Toxic and Hazardous Substances: Vinyl Chloride.
Massachusetts - Substance List: Vinyl Chloride.		

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Vinyl Chloride is on the Proposition 65 lists. **WARNING:** Contains a chemical known to the State of California to cause cancer.

LABELING:

DANGER:

CANCER SUSPECT AGENT.

FLAMMABLE LIQUID AND GAS UNDER PRESSURE.

CAN FORM EXPLOSIVE MIXTURES WITH AIR.

MAY CAUSE LIVER, KIDNEY, SPLEEN AND OTHER ORGAN DAMAGE.

MAY CAUSE IRRITATION TO EYES, SKIN, AND MUCOUS MEMBRANES.

MAY CAUSE FROSTBITE.

Do not breathe gas.

Do not get liquid in skin, in eyes, or on clothing.

Keep away from heat, flames, and sparks.

Store and use with adequate ventilation in closed systems.

Cylinder temperature should not exceed 52°C (125°F).

Close valve after each use and when empty.

Use in accordance with the Material Safety Data Sheet.

15. REGULATORY INFORMATION (Continued)

LABELING (continued):

NOTE:

Suck-back into cylinder may cause rupture.
Always use a back flow preventative device in piping.

FIRST-AID:

IF INHALED: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

IN CASE OF CONTACT, immediately flush eyes or skin with water for at least 15 minutes while removing contaminated clothing and shoes. Call a physician. Wash clothing before reuse. (Discard contaminated shoes)

IN CASE OF FROSTBITE, obtain immediate medical attention.

DO NOT REMOVE THIS PRODUCT LABEL.

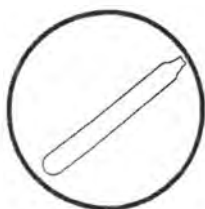
CANADIAN WHMIS SYMBOLS:

Class A: Compressed Gas.

Class B1: Flammable Gas

Class D1B Materials Causing Immediate and Serious Toxic Effects

Class D2A: Other Toxic Material



16. OTHER INFORMATION

PREPARED BY:

Airgas - SAFECOR

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following:

CAS #: This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits.

TLV - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour **Time Weighted Average (TWA)**, the 15-minute **Short Term Exposure Limit**, and the instantaneous **Ceiling Level**. Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration.

PEL - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury.

The DFG - MAK is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). NIOSH issues exposure guidelines called **Recommended Exposure Levels (RELs)**. When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard:

0 (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard:

0 (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure could cause death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature - The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** - concentration expressed in parts of material per million parts of air or water; **mg/m³** - concentration expressed in weight of substance per volume of air; **mg/kg** - quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program. **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. **IARC** and **NTP** rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo** the lowest concentration to cause a symptom; **TD₀**, **LDLo** and **LD₀₁**, or **TC**, **TC₀₁**, **LCLo**, and **LCo**, the lowest dose (or concentration) to cause death. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV.

REGULATORY INFORMATION:

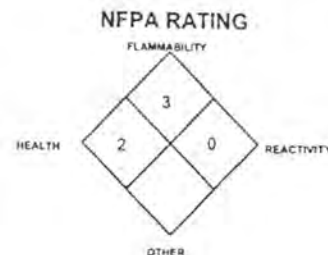
This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. **Superfund Amendments and Reauthorization Act (SARA)**; the **Canadian Domestic Substances List (DSL)**; the U.S. **Toxic Substances Control Act (TSCA)**; Marine Pollutant status according to the **DOT**, California's **Safe Drinking Water Act (Proposition 65)**; the **Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA or Superfund)**; and various state regulations. This section also includes information on the precautionary warnings which appear on the material's package label.



MATERIAL SAFETY DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS

Standards



PART I What is the material and what do I need to know in an emergency?

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS:

XYLENES - C₈H₁₀

Document Number: 1064

PRODUCT USE:

For general analytical/synthetic chemical uses.

SUPPLIER/MANUFACTURER'S NAME:

AIRGAS INC.

ADDRESS:

259 Radnor-Chester Road

Suite 100

Radnor, PA 19087-5240

BUSINESS PHONE:

1-610-687-5253

EMERGENCY PHONE:

CHEMTREC: 1-800-424-9300

International: 202-483-7616

DATE OF PREPARATION:

June 6, 1997

SECOND REVISION:

January 16, 1998

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH		OSHA		IDLH ppm	OTHER
			TLV ppm	STEL ppm	PEL ppm	STEL ppm		
Xylene Three chemical forms (isomers) of Xylene exist: ortho-Xylene, meta-Xylene and para-Xylene. The information presented in this MSDS is given for mixed Xylenes.	1330-20-7	99.9%	100, A4	150	100	150 (Vacated 1989 PEL)	900	NIOSH: 100 TWA; 150 STEL DFG MAK: 100 Carcinogen: IARC-3; TLV-A4; EPA-D
Maximum Impurities		< 0.1	None of the trace impurities in this mixture contribute significantly to the hazards associated with the product. All hazard information pertinent to this product has been provided in this Material Safety Data Sheet, per the requirements of the OSHA Hazard Communication Standard (29 CFR 1910.1200) and State equivalent standards.					

NE = Not Established

C = Ceiling Limit

See Section 16 for Definitions of Terms Used

NOTE: All WHMIS required information is included. It is located in appropriate sections based on the ANSI Z400.1-1993 format.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: Xylene is a colorless, flammable, toxic liquid, with a characteristic aromatic odor. Inhalation of vapors of Xylene can affect the central nervous system. Symptoms of central nervous system overexposure can include headache, drowsiness, dizziness, fatigue, nausea and weakness. Skin and eye contact can be irritating. This liquid is very flammable; vapors are heavier than air and may travel long distances to source of ignition and flashback. If involved in a fire Xylene will decompose to produce toxic gases (e.g. carbon monoxide, carbon dioxide, reactive hydrocarbons and aldehydes). Persons responding to releases of this product must have adequate fire protection for the specific emergency situation.

SYMPTOMS OF OVEREXPOSURE BY ROUTE OF EXPOSURE:

The most significant routes of occupational overexposure for Xylene are by inhalation, and contact with skin or eyes. The symptoms of overexposure to Xylene by route of exposure are as follows:

INHALATION: Possible symptoms of acute overexposure to vapors of Xylene can include flushing of the face, a feeling of increased heat due to dilation of superficial blood vessels, disturbed vision, tremors, salivation, drowsiness, incoordination and staggering gait, confusion and cardiac stress. Exposures to high concentrations of vapors of Xylene can cause central nervous system effects. Symptoms of central nervous system effects are related to exposure concentrations. The effects associated with various levels of Xylene vapors are as follows:

CONCENTRATION

Above 100 ppm:

~ 200 ppm (3-5 min):

~ 700 ppm:

~ 10,000 ppm

SYMPTOM OF EXPOSURE

Headache, dizziness.

Irritation of the nose, throat and respiratory tract.

Nausea and vomiting.

At this concentration Xylene causes incoordination, loss of consciousness, respiratory failure and death.

Other health effects which have been reported for human inhalation overexposure to Xylene include neuro-behavioral effects (e.g., impaired short term memory and reaction time) and alterations in body balance. In an industrial setting, the most serious overexposures have occurred when vapors of Xylene have accumulated in small, confined spaces. Reversible liver and kidney damage has been reported in cases of severe overexposure to Xylene.

CONTACT WITH SKIN or EYES: Contact with the skin can cause irritation, redness and a burning sensation. Such symptoms are reversible if contact ceases. Repeated or prolonged contact can cause dermatitis, resulting in dry, itchy, cracked skin, as Xylene is a defatting agent, removing oils from the skin. Exposure to the eyes at levels of vapor as low as 200 ppm will cause irritation. Direct contact of the liquid with the eyes can cause irritation, conjunctivitis and corneal burns.



SKIN ABSORPTION: Xylene can be absorbed through intact skin, but is not as significant a route of exposure as via inhalation or ingestion. Mild irritation may occur at the site of skin absorption.

INGESTION: Ingestion of Xylene may produce symptoms of central nervous system depression similar to those described in "Inhalation". The estimated lethal dose via ingestion for humans is 15-30 mL. If ingested, Xylene presents a potential aspiration hazard. The aspiration of Xylene into the lungs can result in severe lung irritation, leading to damage to the lungs, chemical pneumonitis, pulmonary edema and hemorrhage.

INJECTION: Injection is not anticipated to be a significant route of overexposure for this product. If Xylene is "injected" (as may occur through punctures by contaminated, sharp objects), symptoms described in "Inhalation" can occur.

OTHER HEALTH EFFECTS: Additional symptoms of chronic overexposure can include paresthesia (morbid sensations), apprehension, tremors, impaired memory, weakness, nervous irritation, vertigo, headache, anorexia, nausea, flatulence, anemia and mucosal hemorrhage.

HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Overexposure to may cause the health effects described on the following page.

HAZARDOUS MATERIAL INFORMATION SYSTEM			
HEALTH		(BLUE)	2
FLAMMABILITY		(RED)	3
REACTIVITY		(YELLOW)	0
PROTECTIVE EQUIPMENT		C	
EYES	RESPIRATORY	HANDS	BODY
	See Section 8		See Section 8
For routine industrial applications			

See Section 16 for Definition of Ratings

3. HAZARD IDENTIFICATION (Continued)

ACUTE: Acute inhalation overexposure to Xylene will initially act as a narcotic, possibly leading to coma in extreme cases. Following exposure to high concentrations, victims may be unconscious, and if exposure continues, death can follow from respiratory failure. Contact with the skin can cause irritation and dermatitis. Contact with the eyes is irritating, causing burning and watering of the eyes. Ingestion of Xylene will cause gastric distress and possible severe depression of the central nervous system. Aspiration of Xylene into the lungs, following ingestion, can result in severe damage to the lungs; death may result.

CHRONIC: Symptoms of chronic inhalation can include respiratory irritation, central nervous system excitation, followed by depression. Xylene is a suspect carcinogen. See Section 11 (Toxicological Information) for further information.

TARGET ORGANS: Respiratory system, central nervous systems, heart, kidneys, skin, eyes and liver.

PART II *What should I do if a hazardous situation occurs?*

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO XYLENE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. If necessary, a Self-Contained Breathing Apparatus should be worn.

INHALATION: If vapors, mists, or sprays of Xylene are inhaled, remove victim to fresh air. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Remove or cover gross contamination to avoid exposure to rescuers.

SKIN EXPOSURE: If Xylene contaminates the skin, immediately begin decontamination with running water. Minimum flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek medical attention if any adverse reaction occurs.

EYE EXPOSURE: If Xylene or its vapors enter the eyes, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing is for 15 minutes. Victim must seek immediate medical attention.

INGESTION: If Xylene is swallowed, CALL PHYSICIAN OR POISON CONTROL CENTER FOR MOST CURRENT INFORMATION. If professional advice is not available, do not induce vomiting. Victim should drink milk, egg whites, or large quantities of water. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or who cannot swallow.

Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention, if necessary. Physicians should refer to "Recommendations to Physicians" in Section 11 (Toxicological Information). Take copy of label and MSDS to health professional with victim.

5. FIRE-FIGHTING MEASURES

FLASH POINT, (Closed Cup): 17-25°C (62.6-77°F)

AUTOIGNITION TEMPERATURE: 464°C (867°F)

FLAMMABLE LIMITS (in air by volume, %):

Lower (LEL): 1.0%

Upper (UEL): 7.0%

FIRE EXTINGUISHING MATERIALS:

Water Spray: YES (for cooling only)

Foam: YES

Halon: YES

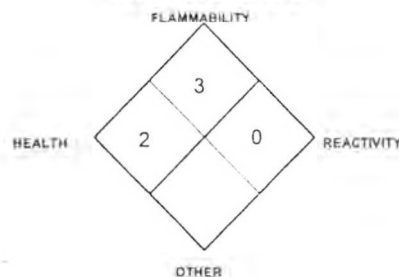
Carbon Dioxide: YES

Dry Chemical: YES

Other: Any "B" Class.

UNUSUAL FIRE AND EXPLOSION HAZARDS: Xylene is a Class IB flammable liquid and presents a serious fire hazard to firefighters. Due to the low flash point, vapors can form explosive mixtures with air, at or above 17°C (63°F). When involved in a fire, this material may decompose and produce toxic gases (e.g., carbon monoxide, carbon dioxide, reactive hydrocarbons and aldehydes). The vapors of Xylene are heavier than air and may spread long distances; distant ignition and flash-back are possible. Xylene can float on water; therefore, water contaminated with this product can spread the flammable liquid and can spread fire. Containers of Xylene, when involved in fire, may rupture or burst in the heat of the fire.

NFPA RATING



See Section 16 for Definition of Ratings

5. FIRE-FIGHTING MEASURES (Continued)

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Xylene can accumulate static charge by flow or agitation; vapors can be ignited by static discharge.

SPECIAL FIRE-FIGHTING PROCEDURES: In the event of fire, cool containers of this product with water to prevent failure. Use a water spray or fog to reduce or direct vapors. Water may not be effective in actually extinguishing a fire involving Xylene, due to its low flash point. Stop the leak or discharge, if possible. For small releases, if it is not possible to stop the leak, and it does not endanger personnel, let the fire burn itself out. Incipient fire responders should wear eye protection. Structural fire fighters must wear Self-Contained Breathing Apparatus and full protective equipment. Large fires should be fought from a distance with an unmanned hose holder or monitor nozzles. If this product is involved in a fire, fire run-off water should be contained to prevent possible environmental damage. If necessary, decontaminate fire-response equipment with soap and water solution. For large releases, consider evacuation. Refer to the North American Emergency Response Guidebook (Guide #130) for additional guidance.

6. ACCIDENTAL RELEASE MEASURES

SPILL AND LEAK RESPONSE: Evacuate immediate area. Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a release, clear the affected area, protect people, and respond with trained personnel.

Minimum Personal Protective Equipment should be **Level B: triple-gloves (rubber gloves and nitrile gloves, over latex gloves), chemically resistant suit and boots, hard-hat, and Self-Contained Breathing Apparatus.** Monitor the surrounding area for combustible vapor levels. Combustible vapor levels must be below 10% of the LEL for Xylene (LEL = 1.0%) before personnel are permitted to enter the area. If necessary, ventilate area.

Monitoring should be done for the levels of Xylene and oxygen. Colorimetric tubes are available to detect the presence of Xylene. Levels of Xylene should be below levels listed in Section 2 (Composition and Information on Ingredients) and the atmosphere must have at least 19.5 percent oxygen before personnel can be allowed in the area without Self-Contained Breathing Apparatus.

Eliminate all sources of ignition before clean-up operations begin. Use non-sparking tools. Absorb spilled liquid with activated carbon, polypads or other suitable absorbent materials. Prevent material from entering sewer or confined spaces. Decontaminate the area thoroughly. Place all spill residue in an appropriate container and seal. If necessary, decontaminate spill-response equipment with soap and water solution. Dispose of in accordance with Federal, State, and local hazardous waste disposal regulations (see Section 13, Disposal Considerations).

THIS IS A TOXIC, FLAMMABLE LIQUID: Protection of all personnel and the area must be maintained. All responders must be adequately protected from exposure.

PART III *How can I prevent hazardous situations from occurring?*

7. HANDLING and STORAGE

WORK PRACTICES AND HYGIENE PRACTICES: As with all chemicals, avoid getting this product ON YOU or IN YOU. Wash hands after handling chemicals. Do not eat or drink while handling this material. Remove contaminated clothing immediately.

STORAGE AND HANDLING PRACTICES: All employees who handle this material should be trained to handle it safely. Avoid breathing vapors or mists generated by this product. Use in a well-ventilated location. Cylinders of this product must be properly labeled. If this product is used in other types of containers, only use portable containers and dispensing equipment (faucet, pump, drip can) approved for flammable liquids. Post "NO SMOKING" signs, where appropriate in storage and use areas.

Store cylinders of this product in a cool, dry location, away from direct sunlight, sources of intense heat, or where freezing is possible. Do not allow area where cylinders are stored to exceed 52°C (125°F). Material should be stored in secondary containers, or in a diked area, as appropriate. Store containers away from incompatible chemicals. Keep container tightly closed when not in use. Storage areas should be made of fire-resistant materials. Inspect all incoming containers before storage, to ensure containers are properly labeled and not damaged. Refer to NFPA 30, Flammable and Combustible Liquids Code for additional information on storage.

Empty containers may contain residual flammable liquid or vapors. Therefore, empty containers should be handled with care. Do not expose "empty" containers to welding touches, or any other source of ignition.

7. HANDLING and STORAGE (Continued)

SPECIAL PRECAUTIONS FOR HANDLING CYLINDERS: Protect cylinders of this product against physical damage. If appropriate, cylinders should be stored in an up-right position. Cylinders should be firmly secured to prevent falling or being knocked over. Cylinders can be stored in the open, but in such cases, should be protected against extremes of weather and from the dampness of the ground to prevent rusting. Never tamper with pressure relief devices in valves and cylinders. Electrical equipment should be non-sparking or explosion proof. The following rules are applicable to situations in which cylinders are being used:

Before Use: If appropriate, move cylinders with a suitable hand truck. Do not drag, slide, or roll cylinders. Do not drop cylinders or permit them to strike each other. Secure cylinders firmly. Leave the valve protection cap in-place until cylinder is ready for use.

During Use: Use designated CGA fittings and other support equipment. Do not use adapters. Do not heat cylinder by any means to increase the discharge rate of the product from the cylinder. Use check valve or trap in discharge line to prevent hazardous backflow into the cylinder. Do not use oils or grease on gas-handling fittings or equipment.

After Use: Close main cylinder valve. Replace valve protection cap. Mark empty cylinders "EMPTY".

NOTE: Use only DOT or ASME code containers. Earth-ground and bond all lines and equipment associated with this product. Close valve after each use and when empty. Cylinders must not be recharged except by or with the consent of owner. For additional information refer to the Compressed Gas Association Bulletin SB-2 "Oxygen Deficient Atmospheres".

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain application equipment is locked and tagged-out safely. Always use this product in areas where adequate ventilation is provided. Decontaminate equipment using soapy water before maintenance begins. Collect all rinsates and dispose of according to applicable Federal, State, or local procedures.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: Use with adequate ventilation. Use a mechanical fan or vent area to outside. Where appropriate, use a non-sparking, grounded ventilation system separate from other exhaust ventilation systems. Ensure eyewash/safety shower stations are available near areas where this product is used.

RESPIRATORY PROTECTION: Maintain exposure levels of Xylene below the levels listed in Section 2 (Composition and Information on Ingredients) and oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection if Xylene levels exceed exposure limits and if oxygen level is below 19.5% or during emergency response to a release of this product. If respiratory protection is required, follow the requirements of the Federal OSHA Respiratory Protection Standard (29 CFR 1910.134), or equivalent State standards. The following NIOSH respiratory protection recommendations are for o-Xylene, (applicable to the mixture of o-Xylene, m-Xylene, and p-Xylene).

CONCENTRATION

RESPIRATORY EQUIPMENT

Up to 900 ppm

Chemical cartridge respirator with organic vapor cartridges; or gas mask with organic vapor canister, or powered, air-purifying respirator with organic vapor cartridges, or Supplied Air Respirator (SAR), or full-facepiece SCBA.

Emergency or Planned Entry into Unknown Concentration or IDLH Conditions: Positive-pressure, full facepiece SCBA or positive pressure, full-facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.

Escape

Gas mask with organic vapor cartridge or escape-type SCBA should be used.

The IDLH concentration for Xylene (o-Xylene, m-Xylene or p-Xylene) is 900 ppm.

EYE PROTECTION: Splash goggles or safety glasses. Face-shields should be worn if contact with the liquid is anticipated.

HAND PROTECTION: Wear leather gloves for handling of cylinders of this product. Wear chemically resistant gloves appropriate for Xylene for industrial use. Gloves should have a resistance to breakthrough greater than 8 hours, such as Teflon™ or Viton™. Butyl rubber, natural rubber, neoprene, nitrile rubber, or polyethylene are not recommended. Use triple gloves for spill response (see Section 6, Accidental Release Measures).

BODY PROTECTION: Use body protection appropriate for task. Transfer of large quantities under pressure may require protective equipment appropriate to protect employees from splashes of liquefied product. Safety shoes are recommended when handling cylinders.

9. PHYSICAL and CHEMICAL PROPERTIES

RELATIVE VAPOR DENSITY (air = 1): 3.7

SPECIFIC GRAVITY (@ 20°C (68°F) (water = 1): 0.86

SOLUBILITY IN WATER @ 25°C (77°F): 130 mg/L

EVAPORATION RATE (nBuAc = 1): 0.7

pH: Not applicable.

FREEZING/MELTING POINT: Variable, depending on isomer blend.

BOILING POINT: 264-302°F (137.2-140°C)

ODOR THRESHOLD: 1 ppm and 20 ppm (detection);
40 ppm (recognition)

SPECIFIC VOLUME: 5.5

EXPANSION RATIO: Not applicable.

LOG COEFFICIENT WATER/OIL DISTRIBUTION: Log P (oct) = 3.12-3.33

VAPOR PRESSURE @ 20°C(68°F): 6-6.5 mm Hg (0.8-0.867 kPa)

APPEARANCE AND COLOR: Colorless, flammable liquid, with a strong, gasoline-like odor.

HOW TO DETECT THIS SUBSTANCE (warning properties): The odor of Xylene is a good warning property as the TLV is more than 10 times the odor threshold. Some olfactory fatigue can occur at low ppm concentrations.

10. STABILITY and REACTIVITY

STABILITY: Normally stable.

DECOMPOSITION PRODUCTS: If Xylene is involved in a fire, it may decompose yielding toxic fumes of carbon monoxide, carbon dioxide, reactive hydrocarbons and aldehydes.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Xylene is incompatible with strong oxidizers, increasing the risk of fire and explosion. Xylene reacts violently to nitric acid and dichlorohydrantoin. Xylene can attack some forms of plastics, rubber and coatings.

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Avoid contact with incompatible materials, sparks, flame static discharge and other sources of ignition. Avoid exposing cylinders to extremely high temperatures, which could cause the cylinders to rupture or burst.

PART III *How can I prevent hazardous situations from occurring?*

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following information is available for Xylene.

Eye effects-Human 200 ppm

Skin-Rabbit, adult 100% Moderate irritation effects

Skin-Rabbit, adult 500 mg/24 hours Moderate irritation effects

Eye effects-Rabbit, adult 87 mg Mild irritation effects

Eye effects-Rabbit, adult 5 mg/24 hours Severe irritation effects

Cytogenetic Analysis-Saccharomyces cerevisiae 1 mmol/tube

Inhalation-Rat TCLo: 50 mg/m³/6 hours (female 1-21 days post):Reproductive effects

Inhalation-Rat TCLo: 50 mg/m³/6 hours (female 1-21 days post):Teratogenic effects

Oral-Human LC₅₀: 50 mg/kg

Inhalation-Man LCLo: 10,000 ppm/6 hours

Inhalation-Human TCLo: 200 ppm: Nose, Eye effects, Pulmonary system effects

Oral-Rat LD50: 4300 mg/kg

Inhalation-Rat LC50: 5000 ppm/4 hours

Intraperitoneal-Rat LD50: 2459 mg/kg

Oral-Unspecified effects LD50: 4300 mg/kg

Inhalation-Unspecified effects LC50: 30 g/m³

SUSPECTED CANCER AGENT: Xylene is listed as follows: EPA-D (No Evidence for Carcinogenicity in Humans); IARC -3 (Not Classifiable as to Human Carcinogenicity).

Xylene is not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA; therefore is neither considered to be nor suspected to be a cancer-causing agent by these agencies.

IRRITANCY OF PRODUCT: Xylene is irritating to the skin, eyes, and other contaminated tissue.

SENSITIZATION OF PRODUCT: Xylene is not known to cause respiratory system or skin sensitization in humans. Cardiac sensitization to stimulants (e.g., epinephrine, ephedrine) is a possible result of severe or chronic overexposure.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of Xylene on the human reproductive system.

Mutagenicity: Mutagenic data are available from clinical studies involving test animals exposed to relatively high doses of Xylene.

11. TOXICOLOGICAL INFORMATION (Continued)

REPRODUCTIVE TOXICITY INFORMATION (continued):

Embryotoxicity: Xylene is not reported to cause embryotoxic effects in humans.

Teratogenicity: Xylene is not reported to cause embryotoxic effects in humans. There have been numerous teratogenicity studies on test animals for mixed xylenes and individual xylene isomers. In general, the results indicate that while xylenes may cause fetotoxic effects at high exposure levels, they are not teratogenic at exposure levels which are not toxic to the mother.

Reproductive Toxicity: Data on reproductive effects are available from clinical studies involving test animals exposed to relatively high doses of Xylene.

*A **mutagen** is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generational lines. An **embryotoxin** is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A **teratogen** is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A **reproductive toxin** is any substance which interferes in any way with the reproductive process.*

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions, central nervous system, liver, kidney, and cardio-vascular conditions may be aggravated by severe or chronic overexposure to this product. Skin disorders may also be aggravated by exposures to Xylene.

RECOMMENDATIONS TO PHYSICIANS: The following guidelines are derived from "Clinical Toxicology of Commercial Chemical Products" (5th edition, 1984).

- Check for signs of impending pulmonary edema.
- Because of the aspiration hazard, avoid emetic drugs, whenever practical.
- For ingestion overexposures in which Xylene contains another toxic component and induction of emesis is advisable: If the patient is not drowsy, comatose, or in respiratory difficulty, induce vomiting. If necessary, as an alternative treatment, remove Xylene from the stomach via gastric lavage. One or two ounces of mineral oil may be instilled and left in the stomach at the completion of lavage.
- Avoid epinephrine because of its possible adverse effect on the sensitized myocardium. Avoid all digestible fats, oils and alcohol, which may promote the absorption of Xylene in the intestinal system.
- If eyes or skin are affected, wash thoroughly and apply a bland analgesic ointment.
- Because of the possibility of ventricular fibrillation, monitor the ECG continuously and be prepared to administer external cardiac massage.
- In chronic solvent abusers, correct dehydration, acidosis, hypokalemia and hypophosphatemia. Usually toxic signs and symptoms (except those due to neuropathies and to cerebellar lesions) disappear within a few days after fluid and electrolyte abnormalities are corrected.

BIOLOGICAL EXPOSURE INDICES (BEIs): The following Biological Exposure Indices (BEIs) are currently applicable for Xylene.

BIOLOGICAL EXPOSURE INDICES (BEIs) for Xylene are as follows:		
CHEMICAL DETERMINANT	SAMPLING TIME	BEI
XYLENES • Methylhippuric acids in urine	• End of shift	• 1.5 g/g creatinine

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: Xylene will be degraded over time into other organic compounds. The following environmental data are available for Xylene.

Log K_{ow} = 3.5-68. Water Solubility = 146-175 mg/L. Bioconcentration Factors = 3.1-3.2 (Estimated); 2.14-2.20 (fish); 1.3 (eels). Xylenes will photochemically degrade; however, xylenes tend to persist in the environment and seem to be very slowly biodegraded. Bioconcentration is not expected to be significant.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: Xylene may be harmful or fatal to contaminated plant and animal-life (especially if large quantities of this product are released). Refer to Section 11 (Toxicology Information) for further information of the effects of this product on test animals.

EFFECT OF CHEMICAL ON AQUATIC LIFE: Xylene can be harmful or fatal to contaminated aquatic plant and animal life. Xylene floats on water, and can potentially form slicks which are capable of creating oxygen-deprived waterways which can contaminate coastal and shore life. Aquatic toxicity data are available for Xylene as follows on the next page:

12. ECOLOGICAL INFORMATION (Continued)

EFFECT OF CHEMICAL ON AQUATIC LIFE (continued):

LC₅₀ (goldfish) = 13 mg/L, 24 hr
LC₅₀ (rainbow trout) = 13.5 mg/L, 96 hr
LC₅₀ (*Pimephales promelas*, fathead minnow) = 46 mg/L, 1 hour;
42 mg/L (24-96 hours)
LC₅₀ (*Carassius auratus*, goldfish) = 16.9 ppm, 96 hr
LC₅₀ (zebra fish, *Brachydanio rerio*) = 20 mg/L, 48 hours, flow-through tests
LC₅₀ (rainbow trout, *Salmo gairdneri*) = 8.05-8.2 mg/L, 96 hours, flow-through and static tests
LC₅₀ (fathead minnow, *Pimephales promelas*) = 16.1 mg/L, 96 hours, flow-through tests
LC₅₀ (bluegill, *Lepomis macrochirus*) = 16.1 mg/L, 96 hours, flow-through tests

LC₅₀ (goldfish, *Carassius auratus*) = 16.1 mg/L, 96 hours, flow-through tests
LC₅₀ (white sucker, *Castostomus commersoni*) = 16.1 mg/L, 96 hours, flow-through tests
LC₅₀ (fathead minnow, *Pimephales promelas*) = 28.77-26.7 mg/L, 24, 48, 96 hours, static tests
LC₅₀ (bluegill, *Lepomis macrochirus*) = 24.0-20.87 mg/L, 24, 48, 96 hours, static tests
LC₅₀ (goldfish, *Carassius auratus*) = 36.81 mg/L, 24, 48, 96 hours, static tests
EC₅₀ (water flea, *Daphnia magna*) = 3.82 mg/L, 48 hours, flow-through tests, sensitive to exposure
EC₅₀ (snail (*Aplexa hypnorum*)) = 22.4 mg/L, 96 hours, resistant to exposure

13. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Return cylinders with residual product to Airgas Inc. Do not dispose of locally.

14. TRANSPORTATION INFORMATION

THIS MATERIAL IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Xylenes
HAZARD CLASS NUMBER and DESCRIPTION: 3 (Flammable Liquid)
UN IDENTIFICATION NUMBER: UN 1307
PACKING GROUP: PG II
DOT LABEL(S) REQUIRED: Flammable Liquid
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (1996): 130

MARINE POLLUTANT: Xylene is not classified by the DOT as a Marine Pollutant (as defined by 49 CFR 172.101, Appendix B).

TRANSPORT CANADA, TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: THIS MATERIAL IS CONSIDERED AS DANGEROUS GOODS. Use the above information for the preparation of Canadian Shipments. In addition, there is an additional Hazard Class: 9.2 (Substance Hazardous to the Environment).

15. REGULATORY INFORMATION

U.S. SARA REPORTING REQUIREMENTS: Xylene is subject to the reporting requirements of Sections 302, 304 and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

COMPONENT	SARA 302 (40 CFR 355, Appendix A)	SARA 304 (40 CFR Table 302.4)	SARA 313 (40 CFR 372.65)
Xylene	NO	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Not applicable.

U.S. CERCLA REPORTABLE QUANTITIES (RQ): 100 lb.

CANADIAN DSL/NDL INVENTORY STATUS: Xylene is on the DSL Inventory.

U.S. TSCA INVENTORY STATUS: Xylene is listed on the TSCA Inventory.

OTHER U.S. FEDERAL REGULATIONS: Xylene is a hazardous substance under Section 311(b)(2A) of the Federal Water Pollution Control Act. Xylene is not listed in Appendix A as a highly hazardous chemical, per 29 CFR 1910.119: Process Safety Management of Highly Hazardous Chemicals. Under this regulation, however, any process that involves a flammable liquid on-site, in one location, in quantities of 10,000 lbs (4,553 kg) or greater is covered under this regulation unless it is used as a fuel.

15. REGULATORY INFORMATION (Continued)

U.S. STATE REGULATORY INFORMATION: Xylene is covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Xylenes.
California - Permissible Exposure Limits for Chemical Contaminants: Xylenes.

Florida - Substance List: Xylenes.

Illinois - Toxic Substance List: Xylenes.

Kansas - Section 302/313 List: Xylenes.

Massachusetts - Substance List: Xylenes.

Michigan Critical Materials Register: Xylenes.

Minnesota - List of Hazardous Substances: Xylenes.

Missouri - Employer Information/Toxic Substance List: Xylenes.

New Jersey - Right to Know Hazardous Substance List: Xylenes.

North Dakota - List of Hazardous Chemicals, Reportable Quantities: Xylenes.

Pennsylvania - Hazardous Substance List: Xylenes.

Rhode Island - Hazardous Substance List: Xylenes.

Texas - Hazardous Substance List: Xylene.

West Virginia - Hazardous Substance List: Xylenes.

Wisconsin - Toxic and Hazardous Substances: Xylenes.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): Xylene is not on the California Proposition 65 Lists.

LABELING: **WARNING!** FLAMMABLE LIQUID AND VAPOR. FLASH POINT = 17-25°C (62.6-77°F). HARMFUL IF INHALED. PROLONGED OR REPEATED SKIN CONTACT MAY DRY SKIN AND CAUSE IRRITATION. CAN CAUSE CENTRAL NERVOUS SYSTEM EFFECTS. CAN CAUSE ADVERSE EFFECTS ON THE BLOOD SYSTEM. LIVER, KIDNEYS. CAN CAUSE DEATH IF TOO MUCH IS BREATHED. ASPIRATION HAZARD IF SWALLOWED - CAN ENTER LUNGS AND CAUSE DAMAGE. Keep away from heat, sparks and flame. Keep container closed. Use only with adequate ventilation. Avoid contact with skin and clothing. Avoid exposure to vapor. Wash thoroughly after handling. **FIRST-AID:** In case of contact, immediately flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if irritation develops or persists. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of fire, use water fog, foam, dry chemical, or CO₂. In case of spill: Absorb spill with inert materials (e.g. activated carbon, dry sand). Flush residual spill with water. Consult Material Safety Data Sheet for additional information.

CANADIAN WHMIS SYMBOLS: Class B2: Flammable Liquid.
Class D2B: Material Causing Other Toxic Effects



16. OTHER INFORMATION

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc.
9163 Chesapeake Drive, San Diego, CA 92123-1002
619/565-0302

The information contained herein is based on data considered accurate. However, no warranty is expressed or implied regarding the accuracy of these data or the results to be obtained from the use thereof. AIRGAS, Inc. assumes no responsibility for injury to the vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, AIRGAS, Inc. assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in his use of the material.

DEFINITIONS OF TERMS

A large number of abbreviations and acronyms appear on a MSDS. Some of these which are commonly used include the following.

CAS # - This is the Chemical Abstract Service Number which uniquely identifies each constituent. It is used for computer-related searching.

EXPOSURE LIMITS IN AIR:

ACGIH - American Conference of Governmental Industrial Hygienists, a professional association which establishes exposure limits. **TLV** - Threshold Limit Value - an airborne concentration of a substance which represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (**TWA**), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (**C**). Skin absorption effects must also be considered.

OSHA - U.S. Occupational Safety and Health Administration. **PEL** - Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based in the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

IDLH - Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. The **DFG - MAK** is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL. **NIOSH** is the National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (**OSHA**). **NIOSH** issues exposure guidelines called Recommended Exposure Levels (**RELs**). When no exposure guidelines are established, an entry of **NE** is made for reference.

HAZARD RATINGS:

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM: Health Hazard:

0 (minimal acute or chronic exposure hazard); **1** (slight acute or chronic exposure hazard); **2** (moderate acute or significant chronic exposure hazard); **3** (severe acute exposure hazard; onetime overexposure can result in permanent injury and may be fatal); **4** (extreme acute exposure hazard; onetime overexposure can be fatal). Flammability Hazard: **0** (minimal hazard); **1** (materials that require substantial pre-heating before burning); **2** (combustible liquid or solids; liquids with a flash point of 38-93°C [100-200°F]); **3** (Class IB and IC flammable liquids with flash points below 38°C [100°F]); **4** (Class IA flammable liquids with flash points below 23°C [73°F] and boiling points below 38°C [100°F]). Reactivity Hazard: **0** (normally stable); **1** (material that can become unstable at elevated temperatures or which can react slightly with water); **2** (materials that are unstable but do not detonate or which can react violently with water); **3** (materials that can detonate when initiated or which can react explosively with water); **4** (materials that can detonate at normal temperatures or pressures).

NATIONAL FIRE PROTECTION ASSOCIATION: Health Hazard: **0** (material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials); **1** (materials that on exposure under fire conditions could cause irritation or minor residual injury); **2** (materials that on intense or continued exposure under fire conditions could cause temporary incapacitation or possible residual injury); **3** (materials that can on short exposure could cause serious temporary or residual injury); **4** (materials that under very short exposure causes death or major residual injury). Flammability Hazard and Reactivity Hazard: Refer to definitions for "Hazardous Materials Identification System".

FLAMMABILITY LIMITS IN AIR:

Much of the information related to fire and explosion is derived from the National Fire Protection Association (**NFPA**). Flash Point - Minimum temperature at which a liquid gives off sufficient vapors to form an ignitable mixture with air. Autoignition Temperature - The minimum temperature required to initiate combustion in air with no other source of ignition. LEL - the lowest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source. UEL - the highest percent of vapor in air, by volume, that will explode or ignite in the presence of an ignition source.

TOXICOLOGICAL INFORMATION:

Possible health hazards as derived from human data, animal studies, or from the results of studies with similar compounds are presented. Definitions of some terms used in this section are: **LD₅₀** - Lethal Dose (solids & liquids) which kills 50% of the exposed animals; **LC₅₀** - Lethal Concentration (gases) which kills 50% of the exposed animals; **ppm** - concentration expressed in parts of material per million parts of air or water; **mg/m³** - concentration expressed in weight of substance per volume of air; **mg/kg** - quantity of material, by weight, administered to a test subject, based on their body weight in kg. Data from several sources are used to evaluate the cancer-causing potential of the material. The sources are: **IARC** - the International Agency for Research on Cancer; **NTP** - the National Toxicology Program; **RTECS** - the Registry of Toxic Effects of Chemical Substances, **OSHA** and **CAL/OSHA**. **IARC** and **NTP** rate chemicals on a scale of decreasing potential to cause human cancer with rankings from 1 to 4. Subrankings (2A, 2B, etc.) are also used. Other measures of toxicity include **TDLo**, the lowest dose to cause a symptom and **TCLo**, the lowest concentration to cause a symptom; **TD₀₁**, **LDLo**, and **LD₀₁** or **TC**, **TC₀₁**, **LCLo**, and **LC₀₁**, the lowest dose (or concentration) to cause lethal or toxic effects. **BEI** - Biological Exposure Indices, represent the levels of determinants which are most likely to be observed in specimens collected from a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the TLV. Ecological Information: **EC** is the effect concentration in water.

REGULATORY INFORMATION:

This section explains the impact of various laws and regulations on the material. **EPA** is the U.S. Environmental Protection Agency. **WHMIS** is the Canadian Workplace Hazardous Materials Information System. **DOT** and **TC** are the U.S. Department of Transportation and the Transport Canada, respectively. Superfund Amendments and Reauthorization Act (**SARA**), the Canadian Domestic/Non-Domestic Substances List (**DSL/NDSL**), the U.S. Toxic Substance Control Act (**TSCA**), Marine Pollutant status according to the **DOT**, the Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA** or **Superfund**) and various state regulations.

POLYSCIENCE -- ALDRIN, 510C-11

MSDS Safety Information

FSC: 6810
MSDS Date: 03/01/1992
MSDS Num: BVBVH
LIIN: 00N047402
Product ID: ALDRIN, 510C-11
MFN: 01
Responsible Party
Cage: IO526
Name: POLYSCIENCE
Address: 7800 MERRIMAC AVE
City: NILES IL 60648
Info Phone Number: 321-965-0611
Emergency Phone Number: 321-965-0611
Published: Y

Contractor Summary

Cage: IO526
Name: POLYSCIENCE
Address: 7800 MERRIMAC AVE
City: NILES IL 60714
Phone: 708-965-0611
Cage: 58378
Name: POLYSCIENCE CORP
Address: 7800 N MERRIMAC AVE
Box: 48312
City: NILES IL 60714-3426
Phone: 708-965-0611

Ingredients

Cas: 309-00-2
RTECS #: IO2100000
Name: 1,4:5,8-DIMETHANONAPHTHALENE,
1,2,3,4,10,10-HEXACHLORO-1,4,4A,5,8,8A-HEXAHYDRO-, ENDO,EXO-; (ALDRIN) (SARA
III)
OSHA PEL: 0.25 MG/M3, S
ACGIH TLV: 0.25 MG/M3, S
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB

Health Hazards Data

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.
Route Of Entry Inds - Inhalation: YES
Skin: NO
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: ACUTE:MAY BE FATAL IF INHALED, SWALLOWED, OR ABSORBED
THROUGH SKIN. MAY CAUSE IRRIT. READILY ABSORBED THROUGH SKIN. MAY CAUSE
VOMITING, DIARRHEA, RENAL DAMAGE, TREMORS, ATAXIA, CONVULSIONS FOLLOWED BY
CNS DEPRESSION, RESP FAILURE, DEATH. CHRONIC: POSSIBLE CARCINOGEN. MAY CAUSE
REPRODUCTIVE (EFTS OF OVEREXP)
Explanation Of Carcinogenicity: NOT RELEVANT
Signs And Symptoms Of Overexposure: HLTH HAZ: DISORDERS. PROLONGED EXPOSURE
CAN CAUSE: NEUROTOXIC EFFECTS. DAMAGE TO THE LIVER. IMMUNOSUPPRESSION.
Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.
First Aid: INGEST:WASH OUT MOUTH W/WATER PROVIDED PERSON IS CONSCIOUS. CALL MD.
SKIN: FLUSH W/COPIOUS AMTS OF WATER FOR AT LEAST 15 MIN. REMOVE CONTAM CLTHG

& SHOES. CALL MD. INHAL: REMOVE TO FRESH AIR. IF BRTHG BECOMES DFCLT,
CALL MD. EYE: FLUSH W/COPIOUS AMTS OF WATER FOR @ LEAST 15 MIN. ASSURE
ADEQUATE FLUSHING BY SEPARATING THE EYELIDS W/FINGERS. CALL A PHYSICIAN.

Handling and Disposal

Spill Release Procedures: WEAR NIOSH/MSHA APPROVED RESP, CHEM SAFETY GOGGLES,
RUBBER BOOTS AND HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN A BAG AND HOLD FOR
WASTE DISPOSAL. AVOID RAISING DUST. VENT AREA & WASH SPILL SITE AFTER MA
TL PICKUP IS COMPLETE.

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods: OBSERVE ALL FEDERAL, STATE AND LOCAL LAWS.

Handling And Storage Precautions: DANGER: POISON. MAY BE FATAL IF INHALED,
SWALLOWED OR ABSORBED THROUGH SKIN. POSSIBLE CARCINOGEN. MAY CAUSE
REPRODUCTIVE DISORDERS.

Other Precautions: READILY ABSORBED THROUGH SKIN. DO NOT GET IN EYES, ON SKIN,
ON CLOTHING. DO NOT BREATHE DUST. USE PROTECTIVE CLOTHING, GLOVES AND DUST.

Fire and Explosion Hazard Information

Extinguishing Media: WATER SPRAY, CARBON DIOXIDE, DRY CHEMICAL POWDER OR
APPROPRIATE FOAM.

Fire Fighting Procedures: WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE
EQUIPMENT (FP N).

Unusual Fire/Explosion Hazard: EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

Control Measures

Respiratory Protection: WEAR NIOSH/MSHA APPROVED RESPIRATOR.

Ventilation: MECHANICAL EXHAUST REQUIRED.

Protective Gloves: CHEMICAL-RESISTANT GLOVES.

Eye Protection: SAFETY GOGGLES.

Other Protective Equipment: OTHER PROTECTIVE CLOTHING.

Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.

Supplemental Safety and Health: NONE SPECIFIED BY MANUFACTURER.

Physical/Chemical Properties

HCC: T4

Solubility in Water: INSOLUBLE

Appearance and Odor: SOLID.

Reactivity Data

Stability Indicator: YES

Stability Condition To Avoid: NONE SPECIFIED BY MANUFACTURER.

Materials To Avoid: NONE SPECIFIED BY MANUFACTURER.

Hazardous Decomposition Products: HYDROGEN CHLORIDE GAS.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: NOT RELEVANT

Toxicological Information

Ecological Information

MSDS Transport Information

Regulatory Information

Other Information

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HAZCOM Label

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Product ID: ALDRIN, 510C-11
Cage: I0526
Assigned IND: Y
Company Name: POLYSCIENCE
Street: 7800 MERRIMAC AVE
City: NILES IL
Zipcode: 60714
Health Emergency Phone: 321-965-0611
Label Required IND: Y
Date Of Label Review: 02/16/1994
Status Code: C
Label Date: 02/16/1994
Origination Code: G
Chronic Hazard IND: Y
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES
Health Hazard: Severe
Contact Hazard: Slight
Fire Hazard: None
Reactivity Hazard: None
Hazard And Precautions: ACUTE: MAY BE FATAL IF INHALED, SWALLOWED OR ABSORBED
THROUGH THE SKIN. MAY CAUSE CNS DEPRESSION, KIDNEY DAMAGE, LUNG FAILURE,
IRRITATION. CHRONIC: NERVE & LIVER DAMAGE.

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SUPELCO INC -- 4,4'-DDT 20UG/ML 1ML, 48678

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MSDS Safety Information

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FSC: 6850

MSDS Date: 09/13/1991

MSDS Num: BLRZG

LIIN: 00N021852

Product ID: 4,4'-DDT 20UG/ML 1ML, 48678

MFN: 01

Responsible Party

Cage: 54968

Name: SUPELCO INC

Address: SUPELCO PARK

City: BELLEFONTE PA 16823-0048

Info Phone Number: 814-359-3441

Emergency Phone Number: 814-359-3441

Published: Y

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Contractor Summary

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Cage: 54968

Name: SIGMA-ALDRICH INC.

Address: 3050 SPRUCE STREET

Box: 14508

City: ST. LOUIS MO 63103

Phone: 314-771-5765/414-273-3850X5996

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Ingredients

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Cas: 50-29-3

RTECS #: KJ3325000

Name: DDT (DICHLORODIPHENYLTRICHLOROETHANE) (SARA III)

% Wt: 0.02

OSHA PEL: S, 1 MG/M3

ACGIH TLV: 1 MG/M3; 9192

EPA Rpt Qty: 1 LB

DOT Rpt Qty: 1 LB

Cas: 67-56-1

RTECS #: PC1400000

Name: METHYL ALCOHOL (METHANOL) (SARA III)

% Wt: 99.98

OSHA PEL: S,200PPM/250STEL

ACGIH TLV: S,200PPM/250STEL; 93

EPA Rpt Qty: 5000 LBS

DOT Rpt Qty: 5000 LBS

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Health Hazards Data

=====

LD50 LC50 Mixture: SEE INGREDIENTS 1 & 2.

Route Of Entry Inds - Inhalation: YES

Skin: NO

Ingestion: YES

Carcinogenicity Inds - NTP: YES

IARC: YES

OSHA: NO

Effects of Exposure: HARMFUL IF INHALED. MAY BE FATAL IF SWALLOWED. CONTAINS
LOW CONCENTRATIONS OF MATLS KNOWN TO STATE OF CALIF TO CAUSE CANCER.

HEADACHE, NAUSEA, GASTROINTESTINAL DISTURBANCES, BLINDNESS.

Explanation Of Carcinogenicity: 4,4-DDT:GROUP 2B(IARC), GROUP 2(NTP).

Signs And Symptoms Of Overexposure: SEE HEALTH HAZARDS.

Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.

First Aid: EYES:FLUSH W/H2O FOR @ LST 15 MIN. CALL MD. SKIN:FLUSH W/LG VOLS OF
H2O. INHAL:IMMED MOVE TO FRESH AIR. IF BRTHG STOPS, GIVE ARTF RESP. CALL MD.

INGEST:NEVER GIVE ANYTHING BY MOUTH TO UNCON PERS. NEVE R TRY TO MAKE UNCON PERS VOMIT. GIVE 2 TABLESPOONS OF BAKING SODA IN GLASS OF H2O. PRESS FINGERS TO BACK OF TONGUE TO INDUCE VOMIT. IMMED CALL MD.

Handling and Disposal

Spill Release Procedures: TAKE UP WITH ABSORBENT MATERIAL. VENTILATE AREA. ELIMINATE ALL IGNITION SOURCES.

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods: COMPLY WITH ALL APPLICABLE FEDERAL, STATE & LOCAL REGULATIONS.

Handling And Storage Precautions: STORE IN SEALED CNTNR IN COOL, DRY LOCATION. KEEP AWAY FROM OXIDIZERS. KEEP AWAY FROM IGNITION SOURCES.

Other Precautions: AVOID EYE/SKIN CONTACT. AVOID BREATHING VAPORS. SUBJ TO REPORTING REQUIREMENTS OF SARA TITLE III, SECTION 313.

Fire and Explosion Hazard Information

Flash Point Text: 50.0F,10.0C

Lower Limits: 6%

Upper Limits: 36.5%

Extinguishing Media: CO2, DRY CHEMICAL, ALCOHOL FOAM.

Fire Fighting Procedures: WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).

Control Measures

Respiratory Protection: WEAR NIOSH/MSHA APPROVED FACE MASK WITH ORGANIC VAPOR CANISTER.

Ventilation: USE ONLY IN WELL VENTILATED AREA.

Protective Gloves: WEAR RUBBER GLOVES.

Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).

Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.

Supplemental Safety and Health: NONE SPECIFIED BY MANUFACTURER.

Physical/Chemical Properties

HCC: F5

B.P. Text: 149F,65C

M.P/F.P Text: -144F,-98C

Vapor Pres: 100 MM

Vapor Density: 1.1

Spec Gravity: 0.79

Evaporation Rate & Reference: >1 (ETHER=1)

Solubility in Water: 100

Appearance and Odor: CLEAR COLORLESS LIQUID

Percent Volatiles by Volume: 100

Reactivity Data

Stability Indicator: YES

Materials To Avoid: OXIDIZING AGENTS, CHRONIC ANHYDRIDE, LEAD PERCHLORATE, PERCHLORIC ACIDS.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: NOT RELEVANT.

Toxicological Information

Ecological Information

MSDS Transport Information

Regulatory Information

Other Information

Transportation Information

Responsible Party Code: 54968
Trans ID NO: 26495
Product ID: 4,4'-DDT 20UG/ML 1ML, 48678
MSDS Prepared Date: 09/13/1991
Review Date: 01/28/1992
MFN: 1
Multiple KIT Number: 0
Review IND: Y

Detail DOT Information

DOT PSN Code: JEZ
Symbols: I
DOT Proper Shipping Name: METHANOL
DOT PSN Modifier: METHYL ALCOHOL SEE METHANOL
Hazard Class: 3
UN ID Num: UN1230
DOT Packaging Group: II
Label: FLAMMABLE LIQUID, POISON
Special Provision: T8
Non Bulk Pack: 202
Bulk Pack: 242
Max Qty Pass: 1 L
Max Qty Cargo: 60 L
Vessel Stow Req: B
Water/Ship/Other Req: 40

Detail IMO Information

IMO PSN Code: JQR
IMO Proper Shipping Name: METHYL ALCOHOL
IMDG Page Number: SEE 3251
UN Number: 1230
UN Hazard Class: 3.2
IMO Packaging Group: II
Subsidiary Risk Label: TOXIC
EMS Number: 3-06
MED First Aid Guide NUM: 306

Detail IATA Information

IATA PSN Code: QHQ
IATA UN ID Num: 1230
IATA Proper Shipping Name: METHANOL
IATA UN Class: 3
Subsidiary Risk Class: 6.1
IATA Label: FLAMM. LIQ. & TOXIC
UN Packing Group: II
Packing Note Passenger: 305
Max Quant Pass: 1L
Max Quant Cargo: 60L
Packing Note Cargo: 307
Exceptions: A104, A113

Detail AFI Information

AFI PSN Code: QHQ

AFI Proper Shipping Name: METHANOL OR METHYL ALCOHOL
AFI Hazard Class: 3
AFI UN ID NUM: UN1230
AFI Packaging Group: II
AFI Label: 6.1
Special Provisions: P4
Back Pack Reference: A7.3

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HAZCOM Label

=====

Product ID: 4,4'-DDT 20UG/ML 1ML, 48678
Cage: 54968
Company Name: SIGMA-ALDRICH INC.
Street: 3050 SPRUCE STREET
PO Box: 14508
City: ST. LOUIS MO
Zipcode: 63103
Health Emergency Phone: 814-359-3441
Label Required IND: Y
Date Of Label Review: 11/18/1991
Status Code: C
Label Date: 11/18/1991
Origination Code: G
Chronic Hazard IND: Y
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES
Health Hazard: Severe
Contact Hazard: Severe
Fire Hazard: Severe
Reactivity Hazard: None
Hazard And Precautions: ACUTE:FLAMMABLE. MAY BE FATAL IF SWALLOWED. HARMFUL IF
INHALED. CAN CAUSE HEADACHE, NAUSEA, GASTROINTESTINAL DISTURBANCES. MAY CAUSE
BLINDNESS. CHRONIC EFFECTS:THIS PRODUCT CONTAINS 4,4-DDT WHICH MAY CAUSE
CANCER.

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viability by or to any person or persons outside the Department of Defense
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United States of America should seek competent professional advice to verify
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particular situation regardless of similarity to a corresponding Department
of Defense or other government situation.

CHEM SERVICE INC -- F102S BHC (ALPHA-ISOMER) 100UG/ML IN TOLUENE

MSDS Safety Information

FSC: 6550
MSDS Date: 12/23/1992
MSDS Num: BWKRQ
LIIN: 00F038139
Product ID: F102S BHC (ALPHA-ISOMER) 100UG/ML IN TOLUENE
MFN: 01
Responsible Party
Cage: 84898
Name: CHEM SERVICE INC
Address: 660 TOWER LN
Box: 3108
City: WEST CHESTER PA 19381-3108
Info Phone Number: 215-692-3026/800-452-9994
Emergency Phone Number: 215-386-2100/800-452-9994
Review Ind: Y
Published: Y

Preparer Co. when other than Responsible Party Co.

Cage: 84898
Name: CHEM SERVICE INC
Box: 3108
City: WEST CHESTER PA 19381

Contractor Summary

Cage: 84898
Name: CHEM SERVICE INC
Box: 3108
City: WEST CHESTER PA 19381
Phone: 215-692-3026
Cage: 8Y898
Name: CHEM SERVICE, INC
Address: 660 TOWER LN
Box: 599
City: WEST CHESTER PA 19301-9650
Phone: 610-692-3026

Ingredients

Cas: 319-84-6
RTECS #: GV3500000
Name: ALPHA-BENZENE HEXACHLORIDE (BHC)
EPA Rpt Qty: 10 LBS
DOT Rpt Qty: 10 LBS

Cas: 108-88-3
RTECS #: XS5250000
Name: TOLUENE (IARC - GROUP 3) *94-4*
Other REC Limits: 375 MG/CUM
OSHA PEL: 100 PPM
ACGIH TLV: 100 PPM
EPA Rpt Qty: 1000 LBS
DOT Rpt Qty: 1000 LBS

Health Hazards Data

LD50 LC50 Mixture: ORAL LD50(RAT): 5000 MG/KG
Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: YES

Carcinogenicity Inds - NTP: NO

IARC: NO

OSHA: NO

Effects of Exposure: EYES: IRRITATION/DAMAGE. INHALATION: HARMFUL, IRRITATION TO RESPIRATORY TRACT. INGESTION: HARMFUL. SKIN: HARMFUL IF ABSORBED W/POTENTIAL ADVERSE HEALTH EFFECTS, IRRITATION. CAN CAUSE LIVER & KIDNEY DAMAGE, BLOOD DISORDERS, NERVOUS SYSTEM INJURY, DELAYED ADVERSE HEALTH EFFECTS & MUCOUS MEMBRANE IRRITATION.

Explanation Of Carcinogenicity: NONE

Signs And Symptoms Of Overexposure: IRRITATION, NAUSEA, HEADACHE, DIZZINESS, GI DISTURBANCES, NARCOTIC EFFECT.

First Aid: EYES: FLUSH W/WATER FOR 15-20 MINS. SKIN: FLUSH W/WATER FOR 15-20 MINS. IF NO BURNS, USE SOAP & WATER. INHALATION: REMOVE TO FRESH AIR. GIVE OXYGEN/CPR IF NECESSARY. IF IN SHOCK, KEEP WARM & QUIET. INGESTION: DON'T INDUCE VOMITING. GIVE MILK/MILK OF MAGNESIA/EGG WHITES BEATEN W/WATER. DON'T GIVE LIQUIDS/INDUCE VOMITING IF UNCONSCIOUS/CONVULSING. (SEE SUPP)

Handling and Disposal

Spill Release Procedures: EVACUATE AREA. WEAR APPROPRIATE OSHA REGULATED EQUIPMENT. VENTILATE AREA. ABSORB ON VERMICULITE/SIMILAR MATERIAL. SWEEP UP & PLACE IN AN APPROPRIATE CONTAINER. HOLD FOR DISPOSAL. WASH CONTAMINATED SURFACES TO REMOVE ANY RESIDUES.

Waste Disposal Methods: BURN IN CHEMICALS INCINERATOR EQUIPPED W/AN AFTERBURNER & SCRUBBER IN ACCORDANCE W/LOCAL, STATE & FEDERAL REGULATIONS.

Handling And Storage Precautions: KEEP TIGHTLY CLOSED. PRODUCT IS FLAMMABLE, VOLATILE & HYGROSCOPIC.

Other Precautions: STORE IN A COOL, DRY PLACE. STORE ONLY W/COMPATIBLE CHEMICALS. AVOID CONTACT W/SKIN, EYES & CLOTHING. DON'T BREATHE VAPORS. PRODUCT IS FOR LABORATORY USE ONLY. NOT TO BE USED AS DRUGS, COSMETICS, AGRICULTURAL/PESTICIDAL PRODUCTS/HOUSEHOLD.

Fire and Explosion Hazard Information

Flash Point Text: 39.92F

Lower Limits: 1.2

Upper Limits: 7.1

Extinguishing Media: CO2/DRY CHEMICAL POWDER. DON'T USE WATER.

Unusual Fire/Explosion Hazard: FLAMMABLE/VOLATILE.

Control Measures

Respiratory Protection: USE APPROPRIATE OSHA/MSHA APPROVED SAFETY EQUIPMENT.

Ventilation: HANDLE ONLY IN A HOOD.

Protective Gloves: REQUIRED.

Eye Protection: EYE SHIELDS

Work Hygienic Practices: REMOVE/LAUNDER CONTAMINATED CLOTHING BEFORE REUSE. READILY ABSORBED & RETAINED ON CLOTHING & SHOES.

Supplemental Safety and Health: FIRST AID CONT'D: IF VOMITING OCCURS, MAKE SURE AIRWAY IS NOT OBSTRUCTED BY VOMIT. OBTAIN MEDICAL ATTENTION IN ALL CASES. DON'T WEAR CONTACT LENSES IN THE LABORATORY. AVOID CONSUMPTION OF ALCOHOL BEFORE & AFTER HANDLING OF THIS COMPOUND, IT WILL INCREASE TOXICITY OF THE COMPOUND. INFORMATION IN THIS MSDS IS FOR TOLUENE

Physical/Chemical Properties

B.P. Text: 231.08F

M.P/F.P Text: -139F

Vapor Pres: 22

Vapor Density: 3.1

Evaporation Rate & Reference: (BU AC=1): 1.9

Solubility in Water: SLIGHT

Appearance and Odor: COLORLESS LIQUID W/AROMATIC ODOR.

Reactivity Data

=====
Stability Indicator: YES
Stability Condition To Avoid: MOISTURE.
Materials To Avoid: STRONG OXIDIZING AGENTS.
Hazardous Decomposition Products: TOXIC FUMES
Hazardous Polymerization Indicator: NO
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Toxicological Information
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Ecological Information
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MSDS Transport Information
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Regulatory Information
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Other Information
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=====
HAZCOM Label
=====

Product ID: F102S BHC (ALPHA-ISOMER) 100UG/ML IN TOLUENE
Cage: 84898
Company Name: CHEM SERVICE INC
PO Box: 3108
City: WEST CHESTER PA
Zipcode: 19381
Health Emergency Phone: 215-386-2100/800-452-9994
Label Required IND: Y
Date Of Label Review: 12/16/1998
Status Code: C
Label Date: 12/16/1998
Origination Code: G

Hazard And Precautions: EYES: IRRITATION/DAMAGE. INHALATION: HARMFUL,
IRRITATION TO RESPIRATORY TRACT. INGESTION: HARMFUL. SKIN: HARMFUL IF
ABSORBED W/POTENTIAL ADVERSE HEALTH EFFECTS, IRRITATION. CAN CAUSE LIVER
& KIDNEY DAMAGE, BLOOD DISORDERS, NERVOUS SYSTEM INJURY, DELAYED ADVERSE
HEALTH EFFECTS & MUCOUS MEMBRANE IRRITATION. IRRITATION,
NAUSEA, HEADACHE, DIZZINESS, GI DISTURBANCES, NARCOTIC EFFECT.

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and assume responsibility for the suitability of this information to their
particular situation regardless of similarity to a corresponding Department
of Defense or other government situation.

BARRE-NATIONAL INC. -- LINDANE USP 1% LOTION

MSDS Safety Information

FSC: 6505
NIIN: 00-355-7035
MSDS Date: 04/01/1991
MSDS Num: BYHHW
Product ID: LINDANE USP 1% LOTION
MFN: 01
Responsible Party
Cage: 57979
Name: BARRE-NATIONAL INC.
Address: 7205 WINDSOR BLVD
City: BALTIMORE MD 21244
Info Phone Number: 410-298-100
Emergency Phone Number: 410-298-100
Preparer's Name: UNKNOWN
Review Ind: Y
Published: Y

Contractor Summary

Cage: 57979
Name: ALPHARMA, U.S. PHARMACEUTICALS DIV (ALIAS: BARRE-NATIONAL INC)
Address: 7205 WINDSOR BLVD
City: BALTIMORE MD 21244
Phone: 410-298-1000
Cage: 47824
Name: RUGBY LABORATORIES INC
Address: 865 MERRICK AVE.
City: WESTBURY NY 11590
Phone: 800-537-3175

Item Description Information

Item Name: LINDANE LOTION, USP
Unit of Issue: BT
Quantitative Expression: 000000000020Z
UI Container Qty: 1
Type of Container: BOTTLE

Ingredients

Cas: 58-89-9
RTECS #: GV4900000
Name: LINDANE, (HEXACHLOROCYCLOHEXANE, GAMMA ISOMER) (SARA 302/313) (CERCLA)
% Wt: 1
Other REC Limits: NONE RECOMMENDED
OSHA PEL: S, 0.5 MG/M3
ACGIH TLV: S, 0.5 MG/M3; 9495
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB

Health Hazards Data

LD50 LC50 Mixture: UNKNOWN
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: CONTRAINDICATED FOR PREMATURE INFANTS AND PATIENTS WITH
KNOWN SEIZURE DISORDERS. ALSO FOR PREGNANT WOMEN. TERATOGENIC
EFFECTS-PREGNANCY CATEGORY B. LINDANE IS SECRETED IN HUMAN BREAST MILK.
LINDANE MAY BE ABSORBED THROUGH THE SKIN; THEREFORE, PROLONGED OR REPEATED
CONTACT SHOULD BE AVOIDED.

Explanation Of Carcinogenicity: NO INGREDIENT OF A CONCENTRATION OF 0.1% OR GREATER IS LISTED AS A CARCINOGEN OR SUSPECTED CARCINOGEN.
Signs And Symptoms Of Overexposure: NONE SPECIFIED BY MANUFACTURER.
Medical Cond Aggravated By Exposure: PREGNANCY-TERATOGENIC EFFECTS-PRGNANCY CATAGORY B.
First Aid: SKIN-WASH THOROUGHLY AFTER CONTACT WITH SKIN. EYES-FLUSH WITH LOTS OF WATER. INGESTED-IF CONSCIOUS, PROMPT GASTRIC LAVAGE SHOULD BE INSTITUTED. SALINE CATHARTICS MAY BE GIVEN.

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Handling and Disposal
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Spill Release Procedures: SCOOP UP AND PLACE IN CLOSED CONTAINER FOR PROPER DISPOSAL.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Methods: DISPOSE OF IN ACCORDANCE WITH LOCAL, STATE AND FEDERAL ENVIRONMENTAL REGULATIONS.
Handling And Storage Precautions: STORE IN A COOL, DRY PLACE.
Other Precautions: NONE SPECIFIED BY MANUFACTURER.

=====
Fire and Explosion Hazard Information
=====

Flash Point Text: UNKNOWN
Lower Limits: UNKNOWN
Upper Limits: UNKNOWN
Extinguishing Media: DLA-- USE MEDIA APPROPRIATE FOR SURROUNDING FIRE.
Fire Fighting Procedures: WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE GEAR. USE WATER TO DISPERSE VAPORS AND COOL FIRE EXPOSED CONTAINERS.
Unusual Fire/Explosion Hazard: WHEN HEATED TO DECOMPOSITION, LINDANE EMITS HIGHLY TOXIC FUMES OF PHOGENE AND HYDROGEN CHLORIDE.

=====
Control Measures
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Respiratory Protection: NONE NORMALLY REQUIRED.
Ventilation: LOCAL EXHAUST.
Protective Gloves: RUBBER TO AVOID PROLONGED CONTACT.
Eye Protection: SPLASH GUARD.
Other Protective Equipment: NONE SPECIFIED BY MANUFACTURER.
Work Hygienic Practices: WASH HANDS AFTER HANDLING AND BEFORE EATING, DRINKING, OR SMOKING. LAUNDER CONTAMINATED CLOTHES BEFORE REUSE.
Supplemental Safety and Health: NDC00364-7326-53 OR NDC00021-0607-02 MAY APPLY.

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Physical/Chemical Properties
=====

HCC: T6
B.P. Text: UNKNOWN
M.P/F.P Text: UNKNOWN
Decomp Text: UNKNOWN
Vapor Pres: UNKNOWN
Vapor Density: UNKNOWN
Spec Gravity: UNKNOWN
Viscosity: UNKNOWN
Evaporation Rate & Reference: UNKNOWN
Solubility in Water: UNKNOWN
Appearance and Odor: WHITE VISCOUS LIQUID.
Corrosion Rate: UNKNOWN

=====
Reactivity Data
=====

Stability Indicator: YES
Stability Condition To Avoid: NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products: NONE SPECIFIED BY MANUFACTURER.
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NONE SPECIFIED BY MANUFACTURER.

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=====
Toxicological Information
=====
Ecological Information
=====
MSDS Transport Information
=====
Regulatory Information
=====
Other Information
=====
Transportation Information
=====
Responsible Party Cage: 57979
Trans ID NO: 70016
Product ID: LINDANE USP 1% LOTION
MSDS Prepared Date: 04/01/1991
Review Date: 03/26/1996
MFN: 1
Net Unit Weight: 0.10 LBS
Multiple KIT Number: 0
Review IND: Y
Unit Of Issue: BT
Container QTY: 1
Type Of Container: BOTTLE
Additional Data: NOT REGULATED FOR SHIPPING PER MFR MSDS.
=====
Detail DOT Information
=====
DOT PSN Code: ZZZ
DOT Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
=====
Detail IMO Information
=====
IMO PSN Code: ZZZ
IMO Proper Shipping Name: NOT REGULATED FOR THIS MODE OF TRANSPORTATION
=====
Detail IATA Information
=====
IATA PSN Code: ZZZ
IATA Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
=====
Detail AFI Information
=====
AFI PSN Code: ZZZ
AFI Proper Shipping Name: NOT REGULATED BY THIS MODE OF TRANSPORTATION
=====
HAZCOM Label
=====
Product ID: LINDANE USP 1% LOTION
Cage: 57979
Company Name: ALPHARMA, U.S. PHARMACEUTICALS DIV (ALIAS: BARRE-NATIONAL INC)
Street: 7205 WINDSOR BLVD
City: BALTIMORE MD
Zipcode: 21244
Health Emergency Phone: 800-537-3175
Date Of Label Review: 03/26/1996
Status Code: C
Label Date: 03/26/1996
Origination Code: Z
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POLYSCIENCE -- DIELDRIN, 510C-12

===== MSDS Safety Information =====

FSC: 6810
MSDS Date: 03/01/1992
MSDS Num: BTYBT
LIIN: 00N047403
Product ID: DIELDRIN, 510C-12
MFN: 01
Responsible Party
Cage: IO526
Name: POLYSCIENCE
Address: 7800 MERRIMAC AVE
City: NILES IL 60648
Info Phone Number: 321-965-0611
Emergency Phone Number: 321-965-0611
Published: Y
=====

Contractor Summary =====

Cage: IO526
Name: POLYSCIENCE
Address: 7800 MERRIMAC AVE
City: NILES IL 60714
Phone: 708-965-0611
Cage: 58378
Name: POLYSCIENCE CORP
Address: 7800 N MERRIMAC AVE
Box: 48312
City: NILES IL 60714-3426
Phone: 708-965-0611
=====

Ingredients =====

Cas: 60-57-1
RTECS #: IO1750000
Name: 1,4:5,8-DIMETHANONAPHTHALENE, 1,2,3,4,10,10-
HEXACHLORO-6,7-EPOXY-1,4,4A,5,6,7,8,8A-OCTAHYDRO, ENDO, EXO-;
OSHA PEL: 0.25 MG/M3, S
ACGIH TLV: 0.25 MG/M3, S
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB
=====

Name: ING 1: (DIELDRIN (SARA III))
=====

Health Hazards Data =====

LD50 LC50 Mixture: LD50: (ORAL,RAT) 38300 UG/KG
Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: NO
OSHA: NO
Effects of Exposure: ACUTE: MAY BE FATAL IF INHALED, SWALLOWED, OR ABSORBED
THROUGH SKIN. MAY CAUSE IRRITATION. CARCINOGEN. MAY ALTER GENETIC MATERIAL.
OVEREXP MAY CAUSE REPROD DISORDER(S) BASED ON TESTS W/LAB ANIMALS. TA RGET
ORGANS: CNS, LIVER, BLOOD. OVEREXPCAN CAUSE: MALAISE, HEADACHE, NAUSEA,
VOMITING, DIZZ, (EFTS OF OVEREXP)
Explanation Of Carcinogenicity: NOT RELEVANT
Signs And Symptoms Of Overexposure: HLTH HAZ: TREMORS, CLONIC AND TONIC
CONVULSIONS, COMA, RESPIRATORY FAILURE.
Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.
First Aid: EYE/SKIN: FLUSH WITH COPIOUS AMOUNTS OF WATER FOR AT LEAST 15 MIN

WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. INHAL: REMOVE TO FRESH AIR.
 IF NOT BRTHG GIVE ARTF RESP. IF BRTHG IS DIFFICULT, GIVE O₂ XYGEN. INGEST:
 WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. CALL A PHYSICIAN.
 WASH CONTAMINATED CLOTHING BEFORE REUSE.

Handling and Disposal

Spill Release Procedures: EVACUATE AREA. WEAR NIOSH/MSHA APPROVED SCBA, RUBBER
 BOOTS AND HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN BAG AND HOLD FOR WASTE
 DISPOSAL. AVOID RAISING DUST. VENTILATE AREA AND WASH SPILL SITE AFTER MAT L
 PICKUP IS COMPLETE.

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods: DISSOLVE OR MIX THE MATL W/A COMBUSTIBLE SOLVENT AND
 BURN IN A CHEMICAL INCINERATOR EQUIPPED WITH AFTERBURNER AND SCRUBBER.
 OBSERVE ALL FEDERAL, STATE AND LOCAL LAWS.

Handling And Storage Precautions: DO NOT BREATHE DUST. DO NOT GET IN EYES, ON
 SKIN, ON CLOTHING. AVOID PRLNGD/RPTD EXPOSURE. READILY ABSORBED THROUGH SKIN.
 HIGHTLY TOXIC. CARCINOGEN.

Other Precautions: MUTAGEN. REPRODUCTIVE HAZARD. KEEP TIGHTLY CLOSED. STORE IN A
 COOL DRY PLACE. MAY CAUSE CANCER. MAY CAUSE HERITABLE GENETIC DAMAGE. VERY
 TOXIC BY INHALATION, IN CONTACT WITH SKIN & IF SWALLOWED. IF YOU FEEL
 UNWELL, SEEK MED ADVICE.

Fire and Explosion Hazard Information

Extinguishing Media: WATER SPRAY, CARBON DIOXIDE, DRY CHEMICAL POWDER OR
 APPROPRIATE FOAM.

Fire Fighting Procedures: WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE
 EQUIPMENT (FP N).

Unusual Fire/Explosion Hazard: EMITS TOXIC FUMES UNDER FIRE CONDITIONS.

Control Measures

Respiratory Protection: WEAR APPROPRIATE NIOSH/MSHA APPROVED RESPIRATOR.

Ventilation: USE ONLY IN A CHEMICAL FUME HOOD.

Protective Gloves: CHEMICAL-RESISTANT GLOVES.

Eye Protection: ANSI APPROVED CHEM WORK GOGG (FP N).

Other Protective Equipment: PROTECTIVE CLOTHING. ANSI APPROVED SAFETY SHOWER
 AND EYE BATH (FP N).

Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.

Supplemental Safety and Health: NONE SPECIFIED BY MANUFACTURER.

Physical/Chemical Properties

HCC: T3

M.P/F.P Text: 289F, 143C

Vapor Density: 13.2

Appearance and Odor: ORANGE-TAN POWDER

Reactivity Data

Stability Indicator: YES

Stability Condition To Avoid: NONE SPECIFIED BY MANUFACTURER.

Materials To Avoid: STRONG OXIDIZING AGENTS.

Hazardous Decomposition Products: TOXIC FUMES OF: CARBON MONOXIDE, CARBON
 DIOXIDE, HYDROGEN CHLORIDE GAS.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: NOT RELEVANT

Toxicological Information

Ecological Information

MSDS Transport Information

Regulatory Information

Other Information

HAZCOM Label

Product ID: DIELDRLN, 510C-12
Cage: IO526
Assigned IND: Y
Company Name: POLYSCIENCE
Street: 7800 MERRIMAC AVE
City: NILES IL
Zipcode: 60714
Health Emergency Phone: 321-965-0611
Label Required IND: Y
Date Of Label Review: 01/26/1994
Status Code: C
Label Date: 01/26/1994
Origination Code: G
Chronic Hazard IND: Y
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: DANGER
Respiratory Protection IND: YES
Health Hazard: Severe
Contact Hazard: Severe
Fire Hazard: None
Reactivity Hazard: None
Hazard And Precautions: ACUTE: MAY BE FATAL IF INHALED, SWALLOWED OR ABSORBED
THROUGH SKIN. MAY CAUSE IRRITATION. OVEREXPOSURE CAN CAUSE: MALAISE,
HEADACHE, NAUSEA, VOMITING, DIZZINESS, TREMORS, CLONIC AND TONIC CONVULSIONS,
COMA, RESPIRATORY FAILURE. CHRONIC: CARCINOGEN. MAY ALTER GENETIC MATERIAL.
OVEREXPOSURE MAY CAUSE REPRODUCTIVE DISORDER(S) BASED ON TESTS W/LAB ANIMALS.
TARGET ORGANS: CNS, LIVER, BLOOD.

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of Defense or other government situation.

CHEM SERVICE INC -- HEPTACHLOR, F100

MSDS Safety Information

FSC: 6810
MSDS Date: 03/17/1992
MSDS Num: CBKZH
LIIN: 00N069924
Product ID: HEPTACHLOR, F100
MFN: 01
Responsible Party
Cage: 84898
Name: CHEM SERVICE INC
Box: 3108
City: WEST CHESTER PA 19381
Info Phone Number: 215-692-3026
Emergency Phone Number: 215-692-3026
Published: Y

Contractor Summary

Cage: 84898
Name: CHEM SERVICE INC
Box: 3108
City: WEST CHESTER PA 19381
Phone: 215-692-3026
Cage: 84898
Name: CHEM SERVICE, INC
Address: 660 TOWER LN
Box: 599
City: WEST CHESTER PA 19301-9650
Phone: 610-692-3026

Ingredients

Cas: 76-44-8
RTECS #: PC0700000
Name: 4,7-METHANOINDENE, 1,4,5,6,7,8,8-HEPTACHLORO-3A,4,7,7A-TETRAHYDRO-;
(HEPTACHLOR) (SARA 313) (CERCLA)
OSHA PEL: 0.5 PPM, S
ACGIH TLV: 0.05 PPM, A3, S
EPA Rpt Qty: 1 LB
DOT Rpt Qty: 1 LB

Name: SUPP DATA: POIS CONTROL CENTER IMMED IF NEC. DO NOT ADMIN LIQUIDS/INDUCE
VOMITING TO AN UNCON/CONVULSING PERS.

OSHA PEL: N/K (FP N)
ACGIH TLV: N/K (FP N)

Name: ING 2: IF PATIENT IS VOMIT - WATCH CLOSELY TO MAKE SURE AIRWAY DOES NOT
BECOME OBSTRUCTED BY VOMIT. GET MED ATTN IF NEC.

Health Hazards Data

LD50 LC50 Mixture: LD50: (ORAL,RAT) 100 MG/KG
Route Of Entry Inds - Inhalation: YES
Skin: YES
Ingestion: YES
Carcinogenicity Inds - NTP: NO
IARC: YES
OSHA: NO

Effects of Exposure: CONTACT LENSES SHOULD NOT BE WORN IN THE LABORATORY. ALL
CHEMICALS SHOULD BE CONSIDERED HAZARDOUS - AVOID DIRECT PHYSICAL CONTACT!
SUSPECTED CARCINOGEN - MAY PRDCE CANCER. MAY BE ADVERSE HEALTH EFFECT S. CAN
CAUSE NERVOUS SYSTEM INJURY. BASED ON TOX OF CMPDS OF SIMILAR STRUCTURE THIS

MATL IS PROBABLY(EFTS OF OVEREXP)
Explanation Of Carcinogenicity: HEPTACHLOR: IARC MONO ON EVAL OF CARCIN RISK OF
CHEMICALS TO MAN, VOL 53, PG 115, 1991: GROUP 2B. ANIMAL LIVER.
Signs And Symptoms Of Overexposure: HLTH HAZ: HIGHLY HAZARDOUS. EXPOSURE CAN
CAUSE LIVER DAMAGE.
Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.
First Aid: AN ANTIDOTE IS SUBSTANCE INTENDED TO COUNTERACT EFT OF POIS. IT
SHOULD BE ADMIN ONLY BY MD/TRAINED EMER PERS. MD ADVICE CAN BE OBTAINED FROM
POIS CNTRL CNTR. EYE:FLUSH CONTINUOUSLY W/WATER FOR 15-20 MI NS. IF NO BURNS
HAVE OCCURRED-USE SOAP & WATER TO CLEANSE SKIN. INHAL: REMOVE PATIENT TO
FRESH AIR. ADMIN O*2 IF PATIENT IS HAVING DFCLTY BRTHG. IF PATIENT HAS
STOPPED BRTHG ADMIN ARTF RESP.(SUPDAT)

=====
Handling and Disposal
=====

Spill Release Procedures: EVAC AREA. WEAR APPROP OSHA REGULATED EQUIP. VENT
AREA. SWEEP UP & PLACE IN APPROP CNTNR. HOLD FOR DISP. WASH CONTAMD
SURFACES TO REMOVE ANY RESIDUES.
Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.
Waste Disposal Methods: BURN IN CHEMICALS INCINERATOR EQUIPPED WITH AN
AFTERBURNER AND SCRUBBER. DISPOSE OF IN ACCORDANCE W/LOCAL, STATE &
FEDERAL REGULATIONS(FP N).
Handling And Storage Precautions: STORE IN COOL, DRY PLACE. STORE ONLY
W/COMPATIBLE CHEMICALS. KEEP TIGHTLY CLOSED. DO NOT BREATHE VAPORS.
Other Precautions: AVOID CONTACT WITH SKIN, EYES AND CLTHG. THIS PRODUCT IS
FURNISHED FOR LABORATORY USE ONLY! OUR PRODUCTS MAY NOT BE USED AS DRUGS,
COSMETICS, AGRICULTURAL OR PESTICIDAL PRODUCTS, FOOD ADDTIVES OR AS H
OUSEHOLD CHEMICALS.

=====
Fire and Explosion Hazard Information
=====

Extinguishing Media: CARBON DIOXIDE, DRY CHEMICAL POWDER OR SPRAY.
Fire Fighting Procedures: WEAR NIOSH/MSHA APPROVED SCBA & FULL PROTECTIVE
EQUIPMENT(FP N).
Unusual Fire/Explosion Hazard: NONE SPECIFIED BY MANUFACTURER.

=====
Control Measures
=====

Respiratory Protection: USE NIOSH/MSHA APPROVED RESPIRATOR APPROPRIATE FOR
EXPOSURE OF CONCERN(FP N).
Ventilation: THIS CHEMICAL SHOULD BE HANDLED ONLY IN HOOD.
Protective Gloves: IMPERVIOUS GLOVES(FP N).
Eye Protection: ANSI APPRVD CHEM WORKERS GOGGS(FP N).
Other Protective Equipment: EMERGENCY EYEWASH & DELUGE SHOWER MEETING ANSI
DESIGN CRITERIA(FP N).
Work Hygienic Practices: NONE SPECIFIED BY MANUFACTURER.
Supplemental Safety and Health: FIRST AID PROC: IF PATIENT IS IN CARDIAC ARREST
ADMIN CPR. CONTINUE LIFE SUPPORTING MEASURES UNTIL MED ASSIST HAS ARRIVED. IF
INGESTED DO NOT INDUCE VOMITING. ANTIDOTE: GASTRIC LAVAGE (E.G. 2-5% SODIU M
BICARBONATE). REMOVE & WASH CONTAMD CLTHG. IF PATIENT IS EXHIBITING SIGNS
OF SHOCK - KEEP WARM & QUIT. CONTACT

=====
Physical/Chemical Properties
=====

M.P/F.P Text: >205F,>96C
Vapor Pres: 3E-4 @ 25C
Solubility in Water: INSOL (IMMISCIBLE)
Appearance and Odor: COLORLESS, CRYSTALLINE SOLID W/CAMPOR LIKE ODOR.

=====
Reactivity Data
=====

Stability Indicator: YES
Stability Condition To Avoid: NONE SPECIFIED BY MANUFACTURER.
Materials To Avoid: NONE SPECIFIED BY MANUFACTURER.
Hazardous Decomposition Products: NONE SPECIFIED BY MANUFACTURER.

Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: NOT RELEVANT.

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Toxicological Information

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Ecological Information

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MSDS Transport Information

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Regulatory Information

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Other Information

=====

HAZCOM Label

=====

Product ID: HEPTACHLOR, F100
Cage: 84898
Company Name: CHEM SERVICE INC
PO Box: 3108
City: WEST CHESTER PA
Zipcode: 19381
Health Emergency Phone: 215-692-3026
Label Required IND: Y
Date Of Label Review: 03/14/1996
Status Code: C
Label Date: 03/14/1996
Origination Code: G
Chronic Hazard IND: Y
Eye Protection IND: YES
Skin Protection IND: YES
Signal Word: WARNING
Respiratory Protection IND: YES
Health Hazard: Moderate
Contact Hazard: Slight
Fire Hazard: None
Reactivity Hazard: None
Hazard And Precautions: ACUTE: CAN CAUSE NERVOUS SYSTEM INJURY. BASED ON
TOXICITY OF COMPOUNDS OF SIMILAR STRUCTURE THIS MATERIAL IS PROBABLY HIGHLY
HAZARDOUS. CHRONIC: CANCER HAZARD. CONTAINS HEPTACHLOR WHICH IS LISTED AS A N
ANIMAL LIVER CARCINOGEN (FP N). EXPOSURE CAN CAUSE LIVER DAMAGE.

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and assume responsibility for the suitability of this information to their
particular situation regardless of similarity to a corresponding Department
of Defense or other government situation.

SUPELCO INC -- GC-MS KIT 625 PENTACHLOROPHENOL, 48729

MSDS Safety Information

FSC: 6850
MSDS Date: 03/31/1991
MSDS Num: BNQHD
LIIN: 00N018095
Product ID: GC-MS KIT 625 PENTACHLOROPHENOL, 48729
MFN: 03
Responsible Party
Cage: 54968
Name: SUPELCO INC
Address: SUPELCO PARK
City: BELLEFONTE PA 16823-0048
Info Phone Number: 814-359-3441
Emergency Phone Number: 814-359-3441
Published: Y

Contractor Summary

Cage: 54968
Name: SIGMA-ALDRICH INC.
Address: 3050 SPRUCE STREET
Box: 14508
City: ST. LOUIS MO 63103
Phone: 314-771-5765/414-273-3850X5996

Ingredients

Cas: 75-09-2
RTECS #: PA8050000
Name: METHANE, DICHLORO-; (METHYLENE CHLORIDE). LD50: (ORAL RAT) 2524 MG/KG.
% Wt: 99.9975
OSHA PEL: 500 PPM,C
ACGIH TLV: 50 PPM
EPA Rpt Qty: 1000 LBS
DOT Rpt Qty: 1000 LBS

Name: SUPP DATA:MYOCARDIUM TO EPINEPHRINE IN LAB ANIMALS & COULD HAVE
SIMILAR EFT IN HUMANS. ADRENOMINETICS (SEE ING 4)

Name: ING 3:(E.G., EPINEPHRINE) MAY BE CONTRAINDICATED EXCEPT FOR
LIFE-SUSTAINING USES IN HUMANS ACUTELY OR (SEE ING 5)

Name: ING 4:CHRONICALLY EXPOSED TO CHLOROCARBONS (FP N).

Name: FIRST AID PROC:NEVER TRY TO MAKE AN UNCONSCIOUS PERSON VOMIT. DO NOT
INDUCE VOMITING. IMMEDIATELY CONTACT MD.

Name: CNDTNS (POLYM):HOT GLOWING SURFACES OR ELECTRIC ARCS CAN DECOMPOSE TO
FORM HYDROGEN CHLORIDE GAS AND TRACES OF PHOSGENE.

Cas: 87-86-5
RTECS #: SM6300000
Name: PHENOL, PENTACHLORO; (PENTACHLOROPHENOL)
% Wt: 0.0025
OSHA PEL: 0.5 MG/M3,S
ACGIH TLV: 0.5 MG/M3,S
EPA Rpt Qty: 10 LBS
DOT Rpt Qty: 10 LBS

Health Hazards Data

LD50 LC50 Mixture: SEE INGREDIENT 2

Route Of Entry Inds - Inhalation: YES

Skin: YES

Ingestion: YES

Carcinogenicity Inds - NTP: YES

IARC: YES

OSHA: NO

Effects of Exposure: MAY BE FATAL IF INHALED. HARMFUL IF SWALLOWED. CNTNS MATLS KNOWN TO STATE OF CALIFORNIA TO CAUSE CANCER. LACHRIMATION. IRRIT SKIN. DERM. HDCH. DIZZ. NARCOSIS. LIVER & KIDNEY DMG. SEVERAL CHRONIC INHAL STUDIES RPTD BY NIOSH REVEALED THAT TEST ANIMALS EXPOSED TO METHYLENE CHLORIDE CONC AS HIGH AS (SEE EFTS OF OVEREXP)

Explanation Of Carcinogenicity: METHYLENE CHLORIDE:GROUP 2B (IARC), GROUP 2 (NTP).

Signs And Symptions Of Overexposure: HLTH HAZ:10,000 PPM SHOWED SLIGHT LIVER/ KIDNEY CHANGES. METHYLENE CHLORIDE HAS BEEN SHOWN TO INCR RATE OF SPONTANEOUSLY OCCURING MALIGNANT TUMORS IN ONE STRAIN OF LAB MICE & BENIGN TUMORS IN LAB RATS . OTHER ANIMAL STUDIES, AS WELL AS SEVERAL HUMAN EPIDEMIOLOGY STUDIES HAVE INDICATED NEGATIVE RESPONSE. (SUPP DATA)

Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.

First Aid: EYE:FLUSH W/WATER FOR AT LEAST 15 MINS. SKIN:PROMPTLY WASH W/MILD SOAP & LGE VOLUMES OF WATER. REMOVE CONTAM CLTHG. INHAL:IMMED REMOVE TO FRESH AIR. GIVE O2 IF BRTHG IS LABORED. IF BRTHG STOPS, GIVE A RTF RESP. GET MD. NEVER GIVE ADRENALIN FOLLOWING CH2CL2 EXPOS. INCR SENSIT OF HEART TO AD ENALIN MAY BE CAUSED BY OVEREXP TO CH2CL2. INGEST:NEVER GIVE ANYTHING BY MOUTH TO UNCON PERS.

Handling and Disposal

Spill Release Procedures: TAKE UP WITH ABSORBENT MATL. VENT AREA. METHYLENE CHLORIDE VAPS ARE HVR/AIR & WILL COLLECT IN LOW AREAS

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods: COMPLY W/ALL APPLICABLE FEDERAL, STATE, OR LOCAL REGULATIONS.

Handling And Storage Precautions: STORE IN SEALED CONTAINER IN COOL, DRY LOCATION.

Other Precautions: POSSIBLE CANCER HAZARD.NO SMOKING IN AREA OF USE. DO NOT USE IN THE GENERAL VICINITY OF ARC WEDING, OPEN FLAMES OR HOT SURFACES. HEAT AND/OR UV RADIATION MAY CAUSE THE FORMATION OF HCL AND/OR PHOSGENE (FP N).

Fire and Explosion Hazard Information

Extinguishing Media: WATER, CO2, DRY CHEMICAL

Fire Fighting Procedures: WEAR NIOSH/MSHA APPROVED SCBA AND FULL PROTECTIVE EQUIPMENT (FP N).

Unusual Fire/Explosion Hazard: THE FOLLOWING TOXIC VAPORS ARE FORMED WHEN THIS MATERIAL IS HEATED TO DECOMPOSITION:HYDROGEN CHLORIDE AND PHOSGENE.

Control Measures

Respiratory Protection: WEAR NIOSH/MSHA APPROVED FACE MASK WITH ORGANIC VAPOR CANISTER.

Ventilation: USE ONLY IN WELL VENTILATED AREA.

Protective Gloves: NEOPRENE GLOVES.

Eye Protection: CHEMICAL WORKERS GOGGLES (FP N).

Supplemental Safety and Health: EFTS OF OVEREXP:METHYLENE CHLORIDE IS NOT BELIEVED TO POSE CARC RISK TO MAN WHEN HNDLD AS REC. CH2CL2 IS METABOLIZED TO CO & CAN STRESS CVS DUE TO INCR CARBOXYHEMOGLOBIN. IN RATS METHYLENE CHLORIDE HA S BEEN SHOWN TO PRODUCE SIGNIFICANT INCR IN SALIVARY GLANDS. CHLOROCARBON MATLS HAVE PRODUCED SENSIT OF (SEE FIG 3)

Physical/Chemical Properties

HCC: T4

B.P. Text: 104F,40C

M.P/F.P Text: -143F,-97C

Vapor Pres: 349
Vapor Density: 2.93 @ 20C
Spec Gravity: 1.320
Evaporation Rate & Reference: (ETHER=1)0.71
Solubility in Water: 1.6
Appearance and Odor: CLEAR COLORLESS LIQUID WITH ETHER LIKE ODOR
Percent Volatiles by Volume: 100

=====
Reactivity Data

=====
Stability Indicator: YES
Materials To Avoid: STRONG BASES AND OXIDIZING AGENTS.
Hazardous Decomposition Products: HYDROGEN CHLORIDE AND PHOSGENE.
Hazardous Polymerization Indicator: NO
Conditions To Avoid Polymerization: LIQ O2 OR OTHER STRONG OXIDANTS MAY FORM
MIXTURES W/METHYLENE CHLORIDE. MATL OR ITS VAPS WHEN IN CONT W/FLAMES
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Toxicological Information

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Ecological Information

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MSDS Transport Information

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Regulatory Information

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Other Information

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Transportation Information

=====
Responsible Party Cage: 54968
Trans ID NO: 22748
Product ID: GC-MS KIT 625 PENTACHLOROPHENOL, 48729
MSDS Prepared Date: 03/31/1991
Review Date: 03/30/1992
MFN: 3
Multiple KIT Number: 0
Review IND: Y
=====

Detail DOT Information

=====
DOT PSN Code: EUP
DOT Proper Shipping Name: DICHLOROMETHANE
Hazard Class: 6.1
UN ID Num: UN1593
DOT Packaging Group: III
Label: KEEP AWAY FROM FOOD
Special Provision: N36,T13
Packaging Exception: 153
Non Bulk Pack: 203
Bulk Pack: 241
Max Qty Pass: 60 L
Max Qty Cargo: 220 L
Vessel Stow Req: A
=====

Detail IMO Information

=====
IMO PSN Code: JXB
IMO Proper Shipping Name: METHYLENE CHLORIDE
IMDG Page Number: SEE 6127
UN Number: 1593

UN Hazard Class: 6.1
IMO Packaging Group: III
Subsidiary Risk Label: -
EMS Number: 6.1-02
MED First Aid Guide NUM: 340

=====

Detail IATA Information

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IATA PSN Code: IYW
IATA UN ID Num: 1593
IATA Proper Shipping Name: DICHLOROMETHANE
IATA UN Class: 6.1
IATA Label: TOXIC
UN Packing Group: III
Packing Note Passenger: 605
Max Quant Pass: 60L
Max Quant Cargo: 220L
Packaging Note Cargo: 612

=====

Detail AFI Information

=====

AFI PSN Code: IYW
AFI Proper Shipping Name: DICHLOROMETHANE
AFI Hazard Class: 6.1
AFI UN ID NUM: UN1593
AFI Packing Group: III
Special Provisions: P5, N36
Back Pack Reference: A10.5

=====

HAZCOM Label

=====

Product ID: GC-MS KIT 625 PENTACHLOROPHENOL, 48729

Cage: 54968

Company Name: SIGMA-ALDRICH INC.

Street: 3050 SPRUCE STREET

PO Box: 14508

City: ST. LOUIS MO

Zipcode: 63103

Label Required IND: Y

Date Of Label Review: 01/06/1992

Status Code: C

Label Date: 01/06/1992

Origination Code: G

Chronic Hazard IND: Y

Eye Protection IND: YES

Skin Protection IND: YES

Signal Word: DANGER

Respiratory Protection IND: YES

Health Hazard: Severe

Contact Hazard: Slight

Fire Hazard: Slight

Reactivity Hazard: None

Hazard And Precautions: ACUTE:EFFECTS OF OVEREXPOSURE:MAY BE FATAL IF INHALED, HARMFUL IF SWALLOWED, LACHRIMATION, IRRITATES SKIN, DERMATITIS, HEADACHE, DIZZINESS, NARCOSIS. METHYLENE CHLORIDE VAPORS ARE HEAVIER THAN AIR AND MAY COLLECT IN LOW AREAS. CHRONIC:CANCER HAZARD. METHYLENE CHLORIDE IS LISTED AS A CARCINOGEN.CAN CAUSE LIVER AND KIDNEY DAMAGE. METHYLENE CHLORIDE IS METABOLIZED TO CO AND CAN STRESS THE CARDIOVASCULAR SYSTEM DUE TO INCREASED CARBOXYHEMOGLOBIN.

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MSDS Number: **N0090** * * * * * *Effective Date: 11/02/01* * * * * * *Supersedes: 02/25/99*

MSDS**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



Mallinckrodt
CHEMICALS



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-296-6665

Outside U.S. and Canada
Chemtec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-562-2537) for assistance.

NAPHTHALENE

1. Product Identification

Synonyms: Naphthene; mothballs; tar camphor; naphthaliin; white-tar

CAS No.: 91-20-3

Molecular Weight: 128.16

Chemical Formula: C₁₀H₈

Product Codes:

J.T. Baker: 2718

Mallinckrodt: 6348

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Naphthalene	91-20-3	90 - 100%	Yes

3. Hazards Identification

Emergency Overview

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO

SKIN, EYES AND RESPIRATORY TRACT. MAY CAUSE ALLERGIC SKIN REACTION. MAY AFFECT LIVER, KIDNEY, BLOOD AND CENTRAL NERVOUS SYSTEM. COMBUSTIBLE.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 2 - Moderate

Flammability Rating: 2 - Moderate

Reactivity Rating: 0 - None

Contact Rating: 2 - Moderate

Lab Protective Equip: GOGGLES; LAB COAT

Storage Color Code: Red (Flammable)

Potential Health Effects

Inhalation:

Inhalation of dust or vapors can cause headache, nausea, vomiting, extensive sweating, and disorientation. The predominant reaction is delayed intravascular hemolysis with symptoms of anemia, fever, jaundice, and kidney or liver damage.

Ingestion:

Toxic. Can cause headache, profuse perspiration, listlessness, dark urine, nausea, vomiting and disorientation. Intravascular hemolysis may also occur with symptoms similar to those noted for inhalation. Severe cases may produce coma with or without convulsions. Death may result from renal failure.

Skin Contact:

Can irritate the skin and, on prolonged contact, may cause rashes and allergy. "Sensitized" individuals may suffer a severe dermatitis.

Eye Contact:

Vapors and solid causes irritation, redness and pain. Very high exposures can damage the nerves of the eye.

Chronic Exposure:

Has led to cataract formation in eyes. May cause skin allergy.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin, blood or vascular disorders or impaired respiratory function may be more susceptible to the effects of the substance. Particularly susceptible individuals are found in the general population, most commonly in dark skinned races.

4. First Aid Measures

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:

Give large amounts of water to drink. Never give anything by mouth to an unconscious person. Get medical attention.

Skin Contact:

Wash skin with soap or mild detergent and water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Call a physician.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

5. Fire Fighting Measures

Fire:

Flash point: 87C (189F) CC

Autoignition temperature: 526C (979F)

Combustible. May be ignited by heat, sparks or flame. May burn rapidly with flare-burning effect. Fire may produce irritating or poisonous gases.

Explosion:

Explosive limits, volume % in air; lel: 0.9; uel: 5.9. Above flashpoint, vapor-air mixtures are explosive within flammable limits noted above. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire or explosion.

Fire Extinguishing Media:

Dry chemical, foam, water or carbon dioxide. Foam or direct water spray on molten naphthalene may cause extensive foaming. Molten naphthalene spatters in contact with water; apply water from as far a distance as possible.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Vapors can flow along surfaces to distant ignition source and flash back.

6. Accidental Release Measures

Remove all sources of ignition. Ventilate area of leak or spill. Wear appropriate personal protective equipment as specified in Section 8. Spills: Clean up spills in a manner that does not disperse dust into the air. Use non-sparking tools and equipment. Reduce airborne dust and prevent scattering by moistening with water. Pick up spill for recovery or disposal and place in a closed container. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect against physical damage. Isolate from any source of heat or ignition. Keep away from moisture and oxidizers. Containers of this material may be hazardous when empty since they retain product residues (dust, solids); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

- OSHA Permissible Exposure Limit (PEL):

10 ppm, 50 mg/m³.

- ACGIH Threshold Limit Value (TLV):

TWA= 10 ppm, 52 mg/m³

STEL= 15 ppm, 79 mg/m³.

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a half-face respirator with an organic vapor cartridge and particulate filter (NIOSH type P95 or R95 filter) may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece respirator with an organic vapor cartridge and particulate filter (NIOSH P100 or R100 filter) may be worn up to 50 times the exposure limit, or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. Please note that N series filters are not recommended for this material. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator. **WARNING:**

Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:

Use chemical safety goggles and/or full face shield where dusting or splashing of solutions is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Appearance:

White crystals.

Odor:

Strong coal tar odor (moth balls).

Solubility:

Insoluble in water.

Specific Gravity:

1.2

pH:

No information found.

% Volatiles by volume @ 21C (70F):

No information found.

Boiling Point:

218C (424F)

Melting Point:

80C (176F)

Vapor Density (Air=1):

4.4

Vapor Pressure (mm Hg):

1 @ 53C (127F)

Evaporation Rate (BuAc=1):

< 1

10. Stability and Reactivity

Stability:

Stable at room temperature in sealed containers. Sublimes appreciably at temperatures above melting point.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Strong oxidizers, strong alkalis and strong mineral acids, mixtures of aluminum trichloride and benzoyl chloride. Reacts violently with chromic anhydride. Melted naphthalene will attack some forms of plastics, rubber, and coatings.

Conditions to Avoid:

Avoid heat, sparks, flames and other ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 490 mg/kg;

Inhalation rat LC50: 340 mg/m3, 1 hour;

Skin rabbit LD50: > 20 g/kg;

Irritation data: skin (open Draize) rabbit 495 mg, mild; eye (standard Draize) rabbit 100 mg, mild;

Investigated as a tumorigen, mutagen and reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Naphthalene (91-20-3)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material may biodegrade to a moderate extent. When released into the soil, this material is expected to leach into groundwater. When released into the soil, this material is expected to quickly evaporate. When released to water, this material is expected to quickly evaporate. When released into water, this material may biodegrade to a moderate extent. When released into the water, this material is expected to have a half-life between 1 and 10 days. This material may bioaccumulate to some extent. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material is expected to have a half-life of less than 1 day.

Environmental Toxicity:

No information found.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: NAPHTHALENE, REFINED
Hazard Class: 4.1
UN/NA: UN1334
Packing Group: III
Information reported for product/size: 1KG

International (Water, I.M.O.)

Proper Shipping Name: NAPHTHALENE, REFINED
Hazard Class: 4.1
UN/NA: UN1334
Packing Group: III
Information reported for product/size: 1KG

International (Air, I.C.A.O.)

Proper Shipping Name: NAPHTHALENE, REFINED
Hazard Class: 4.1
UN/NA: UN1334
Packing Group: III

Information reported for product/size: 1KG

15. Regulatory Information

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-----\Chemical Inventory Status - Part 1\-----
Ingredient                                     TSCA   EC     Japan  Australia
-----
Naphthalene (91-20-3)                       Yes    Yes    Yes     Yes

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-----\Chemical Inventory Status - Part 2\-----
Ingredient                                     Korea  --Canada--
                                     DSL    NDSL    Phil.
-----
Naphthalene (91-20-3)                       Yes    Yes    No      Yes

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-----\Federal, State & International Regulations - Part 1\-----
Ingredient                                     -SARA 302-  -SARA 313-
                                     RQ    TPQ    List  Chemical Catg.
-----
Naphthalene (91-20-3)                       No     No     Yes    No

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-----\Federal, State & International Regulations - Part 2\-----
Ingredient                                     CERCLA  -RCRA-  -TSCA-
                                     261.33  8(d)
-----
Naphthalene (91-20-3)                       100     U165    No

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Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
 Reactivity: No (Pure / Solid)

Australian Hazchem Code: 2Z

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 2 Flammability: 2 Reactivity: 0

Label Hazard Warning:

WARNING! HARMFUL IF SWALLOWED OR INHALED. CAUSES IRRITATION TO SKIN, EYES AND RESPIRATORY TRACT. MAY CAUSE ALLERGIC SKIN REACTION. MAY AFFECT LIVER, KIDNEY, BLOOD AND CENTRAL NERVOUS SYSTEM. COMBUSTIBLE.

Label Precautions:

Avoid contact with eyes, skin and clothing.
 Avoid prolonged or repeated contact with skin.
 Avoid breathing dust.

Avoid breathing vapor.
Keep container closed.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep away from heat, sparks and flame.

Label First Aid:

In all cases call a physician. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. If swallowed, give large amounts of water to drink. Never give anything by mouth to an unconscious person.

Product Use:

Laboratory Reagent.

Revision Information:

MSDS Section(s) changed since last revision of document include: 8.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

MSDS Number: P1952 * * * * * Effective Date: 08/02/00 * * * * * Supersedes: 09/08/97

MSDS**Material Safety Data Sheet**

From: Mallinckrodt Baker, Inc.
222 Red School Lane
Phillipsburg, NJ 08865



Mallinckrodt
CHEMICALS



24 Hour Emergency Telephone: 908-859-2151
CHEMTREC: 1-800-424-9300

National Response in Canada
CANUTEC: 613-996-6666

Outside U.S. and Canada
Chemtrec: 703-527-3887

NOTE: CHEMTREC, CANUTEC and National Response Center emergency numbers to be used only in the event of chemical emergencies involving a spill, leak, fire, exposure or accident involving chemicals.

All non-emergency questions should be directed to Customer Service (1-800-882-2537) for assistance.

PHENOL, LIQUEFIED

1. Product Identification

Synonyms: Carboic acid; Phenic acid; Phenylic acid; Hydroxybenzene;

Monohydroxybenzene

CAS No.: 108-95-2

Molecular Weight: 94.11

Chemical Formula: C₆H₅OH in H₂O

Product Codes:

J.T. Baker: 2859, 2864

Mallinckrodt: 0025, 0221, 0276, 0610

2. Composition/Information on Ingredients

Ingredient	CAS No	Percent	Hazardous
Phenol	108-95-2	88 - 92%	Yes
Water	7732-18-5	8 - 12%	No

3. Hazards Identification

Emergency Overview

POISON! DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. RAPIDLY ABSORBED THROUGH SKIN. CORROSIVE. CAUSES SEVERE BURNS TO EVERY AREA OF CONTACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. COMBUSTIBLE LIQUID AND VAPOR.

J.T. Baker SAF-T-DATA^(tm) Ratings (Provided here for your convenience)

Health Rating: 3 - Severe (Life)

Flammability Rating: 2 - Moderate

Reactivity Rating: 1 - Slight

Contact Rating: 4 - Extreme (Corrosive)

Lab Protective Equip: GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD;
PROPER GLOVES; CLASS B EXTINGUISHER

Storage Color Code: Red Stripe (Store Separately)

Potential Health Effects

The major hazard of phenol is its ability to penetrate the skin rapidly, particularly when liquid, causing severe injury which can be fatal. Phenol also has a strong corrosive effect on body tissue causing severe chemical burns. Due to its local anesthetizing properties, skin burns may be painless.

Inhalation:

Breathing vapor, dust or mist results in digestive disturbances (vomiting, difficulty in swallowing, diarrhea, loss of appetite). Will irritate, possibly burn respiratory tract. Other symptoms listed under ingestion may also occur.

Ingestion:

Poison. Symptoms may include burning pain in mouth and throat, abdominal pain, nausea, vomiting, headache, dizziness, muscular weakness, central nervous system effects, increase in heart rate, irregular breathing, coma, and possibly death. Acute exposure is also associated with kidney and liver damage. Ingestion of 1 gram has been lethal to humans.

Skin Contact:

Corrosive. Rapidly absorbed through the skin with systemic poisoning effects to follow. Discoloration and severe burns may occur, but may be disguised by a loss in pain sensation.

Eye Contact:

Corrosive. Eye burns with redness, pain, blurred vision may occur. May cause severe damage and blindness.

Chronic Exposure:

Repeated exposure may cause symptoms described for acute poisoning as well as eye and skin discoloration.

Aggravation of Pre-existing Conditions:

Persons with pre-existing skin, eye or central nervous system disorders, or impaired liver, kidney, or pulmonary function may be more susceptible to the effects of this substance.

4. First Aid Measures

IN CASE OF PHENOL POISONING, start first aid treatment immediately, then get medical attention. People administering first aid should take precautions to avoid contact with phenol. A phenol antidote kit (castor oil or other vegetable oil, polyethylene glycol 300) should be available in any phenol work area. Actions to be taken in case of phenol poisoning should be planned and practiced before beginning work with phenol. Castor oil and or polyethylene glycol can be given by a first responder before medical help arrives.

Inhalation:

Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Ingestion:

If swallowed, immediately administer castor oil or other vegetable oil. Never give anything by mouth to an unconscious person. Be ready to induce vomiting at the advice of physician or poison control center. Castor oil (or vegetable oil) dosage should be between 15 and 30 cc. Get medical attention immediately.

Skin Contact:

In case of skin contact, immediately flush skin with large amounts of water while removing contaminated clothing and shoes. As soon as possible, repeatedly apply polyethylene glycol to affected area. Destroy contaminated clothing and shoes. Flush skin with water for at least 30 minutes. It is very important to avoid rubbing or wiping affected parts which would aggravate irritation and cause product dispersion. Continue treatment until the burned area changes color from white to pink. Expect that this can take a long period of time (20 minutes or more). The polyethylene glycol application should be done during transportation to the hospital. If polyethylene glycol is not available, flush with water for at least 30 minutes prior to going to hospital. Get medical attention immediately.

Eye Contact:

Immediately flush eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

Note to Physician:

Treat ingestion with gastric lavage using 40% aqueous Bacto-Peptide, milk or water until phenolic odor is eliminated. Then give 15 to 50 cc castor or vegetable oil. Debride necrotic skin. Monitor vital signs, fluid status, electrolytes, BUN, renal and hepatic function, and electrocardiogram. Manage sedation, seizures, renal failure, and fluid electrolyte imbalances symptomatically as indicated.

5. Fire Fighting Measures

Fire:

Flash point: 79C (174F) CC

Autoignition temperature: 715C (1319F)

Flammable limits in air % by volume:

lcl: 1.3; ucl: 8.6

Combustible. Contact with strong oxidizers may cause fire.

Explosion:

Above flash point, vapor-air mixtures are explosive within flammable limits noted above.

Sealed containers may rupture when heated.

Fire Extinguishing Media:

Water spray, dry chemical, alcohol foam, or carbon dioxide. Water spray may be used to keep fire exposed containers cool.

Special Information:

In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode. Structural firefighter's protective clothing is ineffective for fires involving this material. Stay away from sealed containers.

6. Accidental Release Measures

Ventilate area of leak or spill. Remove all sources of ignition. Wear appropriate personal protective equipment as specified in Section 8. Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Contain and recover liquid when possible. Use non-sparking tools and equipment. Collect liquid in an appropriate container or absorb with an inert material (e. g., vermiculite, dry sand, earth), and place in a chemical waste container. Do not use combustible materials, such as saw dust. Do not flush to sewer! Dry lime or soda ash may be used on spill for neutralization. US Regulations (CERCLA) require reporting spills and releases to soil, water and air in excess of reportable quantities. The toll free number for the US Coast Guard National Response Center is (800) 424-8802.

7. Handling and Storage

Keep in a tightly closed container. Store in a cool, dry, ventilated area away from sources of heat or ignition. Protect against physical damage. Store separately from reactive or combustible materials, and out of direct sunlight. All phenol workers should be properly trained on its hazards and the proper protective measures required. This training should also include emergency actions. All phenol operations should be enclosed to eliminate any potential exposure routes. Containers of this material may be hazardous when empty since they retain product residues (vapors, liquid); observe all warnings and precautions listed for the product.

8. Exposure Controls/Personal Protection

Airborne Exposure Limits:

Phenol:

-OSHA Permissible Exposure Limit (PEL):
5 ppm (TWA) (skin)

-ACGIH Threshold Limit Value (TLV):
5 ppm (TWA) (skin)

Ventilation System:

A system of local and/or general exhaust is recommended to keep employee exposures below

the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, *Industrial Ventilation, A Manual of Recommended Practices*, most recent edition, for details.

Personal Respirators (NIOSH Approved):

If the exposure limit is exceeded, a full facepiece respirator with organic vapor cartridge and dust/mist filter may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-facepiece positive-pressure, air-supplied respirator. **WARNING:** Air purifying respirators do not protect workers in oxygen-deficient atmospheres.

Skin Protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact. Butyl rubber and neoprene are suitable materials for personal protective equipment.

Eye Protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

9. Physical and Chemical Properties

Congealing Point: 10.5-14C (50.9-57.2F)

Appearance:

Colorless to light pink liquid.

Odor:

Sharp, medicinal, sweet, tarry.

Solubility:

1 g/15 ml of water: very soluble in alcohol.

Specific Gravity:

1.06 @ 20C/4C

pH:

No information found.

% Volatiles by volume @ 21C (70F):

100

Boiling Point:

182C (360F)

Melting Point:

No information found.

Vapor Density (Air=1):

3.2

Vapor Pressure (mm Hg):

0.4 @ 20C (68F)

Evaporation Rate (BuAc=1):

< 0.01

10. Stability and Reactivity

Stability:

Stable under ordinary conditions of use and storage. Heat will contribute to instability.

Hazardous Decomposition Products:

Carbon dioxide and carbon monoxide may form when heated to decomposition. Toxic gases and vapors may be released if involved in a fire.

Hazardous Polymerization:

Will not occur.

Incompatibilities:

Oxidizers, aluminum chloride and nitrobenzene, calcium hypochlorite, butadiene, halogens, formaldehyde, mineral oxidizing acids, isocyanates, sodium nitrite and many other materials. Hot liquid phenol will attack aluminum, magnesium, lead, and zinc metals.

Conditions to Avoid:

Heat, flames, ignition sources and incompatibles.

11. Toxicological Information

Oral rat LD50: 317 mg/Kg; skin rabbit LD50:630 mg/kg; inhalation rat LC50: 316 mg/m3; irritation data: skin rabbit, standard Draize, 500 mg/24H severe; eye rabbit, standard Draize 5 mg/30S rinse, mild. Investigated as a tumorigen, mutagen, reproductive effector.

-----\Cancer Lists\-----			
Ingredient	---NTP Carcinogen---		IARC Category
	Known	Anticipated	
Phenol (108-95-2)	No	No	3
Water (7732-18-5)	No	No	None

12. Ecological Information

Environmental Fate:

When released into the soil, this material is expected to readily biodegrade. When released into the soil, this material is not expected to leach into groundwater. When released into the soil, this material may evaporate to a moderate extent. When released into the soil, this material is expected to have a half-life between 1 and 10 days. When released into water, this material is expected to readily biodegrade. When released into water, this material is not expected to evaporate significantly. When released into water, this material is expected to have a half-life between 10 and 30 days. This material has an estimated bioconcentration factor (BCF) of less than 100. This material is not expected to significantly bioaccumulate. When released into the air, this material is expected to be readily degraded by reaction with photochemically produced hydroxyl radicals. When released into the air, this material may be moderately degraded by photolysis. When released into the air, this material is expected to have a half-life of less than 1 day.

Environmental Toxicity:

This material is expected to be toxic to aquatic life. The LC50/96-hour values for fish are between 10 and 100 mg/l.

13. Disposal Considerations

Whatever cannot be saved for recovery or recycling should be handled as hazardous waste and sent to a RCRA approved incinerator or disposed in a RCRA approved waste facility. Processing, use or contamination of this product may change the waste management options. State and local disposal regulations may differ from federal disposal regulations. Dispose of container and unused contents in accordance with federal, state and local requirements.

14. Transport Information

Domestic (Land, D.O.T.)

Proper Shipping Name: PHENOL SOLUTIONS
Hazard Class: 6.1
UN/NA: UN2821
Packing Group: II
Information reported for product/size: 50LB

International (Water, I.M.O.)

Proper Shipping Name: PHENOL SOLUTIONS
Hazard Class: 6.1
UN/NA: UN2821
Packing Group: II
Information reported for product/size: 50LB

15. Regulatory Information

-----\Chemical Inventory Status - Part 1\-----

Ingredient	TSCA	EC	Japan	Australia
Phenol (108-95-2)	Yes	Yes	Yes	Yes
Water (7732-18-5)	Yes	Yes	Yes	Yes

-----\Chemical Inventory Status - Part 2\-----

Ingredient	Korea	DSL	NDSL	Phil.
Phenol (108-95-2)	Yes	Yes	No	Yes
Water (7732-18-5)	Yes	Yes	No	Yes

-----\Federal, State & International Regulations - Part 1\-----

Ingredient	-SARA 302- RQ	TPQ	-----SARA 313----- List	Chemical Catg.
Phenol (108-95-2)	1000	500*	Yes	No
Water (7732-18-5)	No	No	No	No

-----Federal, State & International Regulations - Part 2-----			
Ingredient	CERCLA	-RCRA-	-TSCA-
		261.33	8(d)
Phenol (108-95-2)	1000	U188	No
Water (7732-18-5)	No	No	No

Chemical Weapons Convention: No TSCA 12(b): No CDTA: No
 SARA 311/312: Acute: Yes Chronic: Yes Fire: Yes Pressure: No
 Reactivity: No (Mixture / Liquid)

Australian Hazchem Code: 2X

Poison Schedule: S6

WHMIS:

This MSDS has been prepared according to the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all of the information required by the CPR.

16. Other Information

NFPA Ratings: Health: 4 Flammability: 2 Reactivity: 0

Label Hazard Warning:

POISON! DANGER! MAY BE FATAL IF SWALLOWED, INHALED OR ABSORBED THROUGH SKIN. RAPIDLY ABSORBED THROUGH SKIN. CORROSIVE. CAUSES SEVERE BURNS TO EVERY AREA OF CONTACT. AFFECTS CENTRAL NERVOUS SYSTEM, LIVER AND KIDNEYS. COMBUSTIBLE LIQUID AND VAPOR.

Label Precautions:

Do not breathe vapor.
 Do not get in eyes, on skin, or on clothing.
 Keep container closed.
 Use only with adequate ventilation.
 Wash thoroughly after handling.
 Keep away from heat, sparks and flame.

Label First Aid:

IN ALL CASES, GET MEDICAL ATTENTION IMMEDIATELY. KEEP A PHENOL ANTIDOTE KIT in area of product use or storage. Administer castor oil and/or polyethylene glycol per pre-planned directions. If swallowed, immediately administer castor oil or other vegetable oil. Never give anything by mouth to an unconscious person. In case of skin contact, immediately flush skin with large amounts of water while removing contaminated clothing and shoes. As soon as possible, repeatedly apply polyethylene glycol to affected area. Destroy contaminated clothing and shoes. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of eye contact, immediately flush eyes with plenty of water for at least 15 minutes while lifting lower and upper eyelids.

Product Use:

Laboratory Reagent.

Revision Information:

No changes.

Disclaimer:

Mallinckrodt Baker, Inc. provides the information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. This document is intended only as a guide to the appropriate precautionary handling of the material by a properly trained person using this product. Individuals receiving the information must exercise their independent judgment in determining its appropriateness for a particular purpose. MALLINCKRODT BAKER, INC. MAKES NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR THE PRODUCT TO WHICH THE INFORMATION REFERS. ACCORDINGLY, MALLINCKRODT BAKER, INC. WILL NOT BE RESPONSIBLE FOR DAMAGES RESULTING FROM USE OF OR RELIANCE UPON THIS INFORMATION.

Prepared by: Environmental Health & Safety
Phone Number: (314) 654-1600 (U.S.A.)

**** SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION ****

MSDS Name: Benzo[a]pyrene-7,8-d2, 98%

Catalog Numbers:

AC329560000, AC329561000, AC329565000

Synonyms:

3,4-Benzopyrene-7,8-d2; 3,4-Benzpyrene-7,8-d2;

Benzo[def]chrysene-7,8-d2

Company Identification (Europe): Acros Organics BVBA

Janssen Pharmaceuticulaan 3a

2440 Geel, Belgium

Company Identification (USA):

Acros Organics

One Reagent Lane

Fairlawn, NJ 07410

For information in North America, call: 800-ACROS-01

For information in Europe, call: 0032(0) 14575211

For emergencies in the US, call CHEMTREC: 800-424-9300

For emergencies in Europe, call: 0032(0) 14575299

**** SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS ****

CAS#	Chemical Name	%	EINECS#
0-01-1	Benzo[a]pyrene-7,8-d2	98%	unlisted

Hazard Symbols: T N

Risk Phrases: 45 46 60 61 50/53

**** SECTION 3 - HAZARDS IDENTIFICATION ****

EMERGENCY OVERVIEW

Appearance: yellow.

Hygroscopic.

Target Organs: Lungs, skin.

Potential Health Effects

Eye:

May cause eye irritation.

Skin:

May cause skin irritation. Harmful if absorbed through the skin.

Ingestion:

Harmful if swallowed. May cause irritation of the digestive tract.

Inhalation:

Harmful if inhaled. May cause respiratory tract irritation.

Chronic:

Not available.

**** SECTION 4 - FIRST AID MEASURES ****

Eyes:

Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.

Skin:

Get medical aid immediately. Immediately flush skin with plenty of soap and water for at least 15 minutes while removing contaminated clothing and shoes.

Ingestion:

Get medical aid immediately. Wash mouth out with water.

Inhalation:

Get medical aid immediately. Remove from exposure to fresh air immediately. If not breathing, give artificial respiration. If

breathing is difficult, give oxygen.
Notes to Physician:
Treat symptomatically and supportively.

**** SECTION 5 - FIRE FIGHTING MEASURES ****

General Information:

As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear.

Extinguishing Media:

In case of fire, use water, dry chemical, chemical foam, or alcohol-resistant foam.

Autoignition Temperature: Not available.

Flash Point: Not available.

Explosion Limits, lower: Not available.

Explosion Limits, upper: Not available.

NFPA Rating: Not published.

**** SECTION 6 - ACCIDENTAL RELEASE MEASURES ****

General Information: Use proper personal protective equipment as indicated in Section 8.

Spills/Leaks:

Vacuum or sweep up material and place into a suitable disposal container. Avoid generating dusty conditions.

**** SECTION 7 - HANDLING and STORAGE ****

Handling:

Do not breathe dust, vapor, mist, or gas. Do not get in eyes, on skin, or on clothing. Use only in a chemical fume hood.

Storage:

Store in a cool, dry place. Store in a tightly closed container. Keep under a nitrogen blanket.

**** SECTION 8 - EXPOSURE CONTROLS, PERSONAL PROTECTION ****

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Benzo[a]pyrene-7,8-d2	none listed	none listed	none listed

OSHA Vacated PELs:

Benzo[a]pyrene-7,8-d2:

No OSHA Vacated PELs are listed for this chemical.

Personal Protective Equipment

Eyes:

Not available.

Skin:

Wear appropriate protective gloves to prevent skin exposure.

Clothing:

Wear appropriate protective clothing to prevent skin exposure.

Respirators:

Follow the OSHA respirator regulations found in 29CFR 1910.134 or European Standard EN 149. Always use a NIOSH or European Standard EN 149 approved respirator when necessary.

**** SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES ****

Physical State: Crystalline powder
Appearance: yellow
Odor: Not available.
pH: Not available.
Vapor Pressure: Not available.
Vapor Density: Not available.
Evaporation Rate: Not available.
Viscosity: Not available.
Boiling Point: Not available.
Freezing/Melting Point: 177 - 179 deg C
Decomposition Temperature:
Solubility in water: Not available.
Specific Gravity/Density:
Molecular Formula: C20H10D2
Molecular Weight: 254.098

**** SECTION 10 - STABILITY AND REACTIVITY ****

Chemical Stability:
Stable.
Conditions to Avoid:
Incompatible materials, exposure to moist air or water.
Incompatibilities with Other Materials:
Oxidizing agents.
Hazardous Decomposition Products:
Carbon monoxide, carbon dioxide.
Hazardous Polymerization: Will not occur.

**** SECTION 11 - TOXICOLOGICAL INFORMATION ****

RTECS#:
CAS# 0-01-1 unlisted.
LD50/LC50:
Not available.
Carcinogenicity:
Benzo[a]pyrene-7,8-d2 -
Not listed by ACGIH, IARC, NIOSH, NTP, or OSHA.
Epidemiology:
No data available.
Teratogenicity:
No data available.
Reproductive Effects:
No data available.
Neurotoxicity:
No data available.
Mutagenicity:
No data available.
Other Studies:
Mutagen. Teratogen. See actual entry in RTECS for complete information.

**** SECTION 12 - ECOLOGICAL INFORMATION ****

**** SECTION 13 - DISPOSAL CONSIDERATIONS ****

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste.

US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series: None listed.

**** SECTION 14 - TRANSPORT INFORMATION ****

US DOT

No information available

Canadian TDG

No information available.

**** SECTION 15 - REGULATORY INFORMATION ****

US FEDERAL

TSCA

CAS# 0-01-1 is not listed on the TSCA inventory.

It is for research and development use only.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.
Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

SARA

Section 302 (RQ)

None of the chemicals in this material have an RQ.

Section 302 (TPQ)

None of the chemicals in this product have a TPQ.

Section 313

No chemicals are reportable under Section 313.

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depleters.

This material does not contain any Class 2 Ozone depleters.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA.

None of the chemicals in this product are listed as Priority Pollutants under the CWA.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

Benzo[a]pyrene-7,8-d2 is not present on state lists from CA, PA, MN, MA, FL, or NJ.

California No Significant Risk Level:

None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: T N

Risk Phrases:

R 45 May cause cancer.

- R 46 May cause heritable genetic damage.
R 60 May impair fertility.
R 61 May cause harm to the unborn child.
R 50/53 Very toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

- S 53 Avoid exposure - obtain special instructions before use.
S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S 60 This material and/or its container must be disposed of as hazardous waste.
S 61 Avoid release to the environment. Refer to special instructions/Safety data sheets.

WGK (Water Danger/Protection)

CAS# 0-01-1: No information available.

United Kingdom Occupational Exposure Limits

Canada

None of the chemicals in this product are listed on the DSL/NDSL list.

WHMIS: Not available.

CAS# 0-01-1 is not listed on Canada's Ingredient Disclosure List.

Exposure Limits

**** SECTION 16 - ADDITIONAL INFORMATION ****

MSDS Creation Date: 11/22/1999 Revision #1 Date: 8/03/2000

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no way shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if the company has been advised of the possibility of such damages.

ALDRICH CHEMICAL INC -- PHENANTHRENE 98%, P1140-9

MSDS Safety Information

FSC: 6810
 MSDS Date: 05/28/1997
 MSDS Num: CGNRV
 LIIN: 00N014546
 Product ID: PHENANTHRENE 98%, P1140-9
 MFN: 02
 Responsible Party
 Cage: 60928
 Name: ALDRICH CHEMICAL CO INC
 Box: 355
 City: MILWAUKEE MI 52301
 Info Phone Number: 414-273-3850
 Emergency Phone Number: 414-273-3850
 Published: Y

Contractor Summary

Cage: 60928
 Name: ALDRICH CHEMICAL CO INC
 Address: 1001 WEST ST PAUL AVE
 Box: 355
 City: MILWAUKEE WI 53233
 Phone: 414-273-3850

Ingredients

Cas: 85-01-8
 RTECS #: SF7175000
 Name: PHENANTHRENE (CERCLA)
 OSHA PEL: N/K (FP N)
 ACGIH TLV: N/K (FP N)
 EPA Rpt Qty: 5000 LBS
 DOT Rpt Qty: 5000 LBS

Health Hazards Data

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route Of Entry Inds - Inhalation: YES

Skin: YES

Ingestion: YES

Carcinogenicity Inds - NTP: NO

IARC: NO

OSHA: NO

Effects of Exposure: ACUTE: HARMFUL IF SWALLOWED. MAY BE HARMFUL IF INHALED.
 MAY BE HARMFUL IF ABSORBED THRU SKIN. CAUSES EYE & SKIN IRRIT. MATL IS
 IRRITATING TO MUC MEMBRANES & UPPER RESP TRACT. CAUSES PHOTOSENSITIVITY.
 EXPOS TO LIGHT CAN RSLT IN ALLERGIC REACTIONS RESULTING IN DERMATOLOGIC
 LESIONS, WHICH CAN VARY FROM (EFTS OF OVEREXP)

Explanation Of Carcinogenicity: NOT RELEVANT.

Signs And Symptoms Of Overexposure: HLTH HAZ: SUNBURNLIKE RESPONSES TO
 EDEMATOUS, VESTICULATED LESIONS/BULLAE. CHRONIC: LAB EXPERIMENTS HAVE SHOWN
 MUTAGENIC EFTS. ADDNL INFO: CAN CAUSE SKIN PHOTOSENSITIZATION. TARGET ORGAN
 DATA: SKIN & APPENDAGES(TUMORS). TUMORIGENIC: (NEOPLASTIC BY RTECS
 CRITERIA) (TUMORS AT SITE OF APPLIC). ONLY SELECTED (SUPDAT)

Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.

First Aid: EYES: IMMEDIATELY FLUSH WITH COPIOUS AMTS OF WATER FOR AT LST 15
 MINUTES. SKIN: IMMEDIATELY WASH WITH SOAP & COPIOUS AMTS OF WATER. INHAL:
 REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTF RESP. IF BREA THING IS
 DIFFICULT, GIVE OXYGEN. INGEST: WASH OUT MOUTH WITH WATER PROVIDED PERSON IS
 CONSCIOUS. CALL PHYS. DISCARD CONTAMINATED CLOTHING AND SHOES.

Handling and Disposal

=====

Spill Release Procedures: WEAR NIOSH APPRVD SCBA, RUBBER BOOTS AND HEAVY RUBBER GLOVES. SWEEP UP, PLACE IN BAG AND HOLD FOR WASTE DISPOSAL. AVOID RAISING DUST. VENTILATE AREA AND WASH SPILL SITE AFTER MATERIAL PICKUP IS COMPLETE.

Neutralizing Agent: NONE SPECIFIED BY MANUFACTURER.

Waste Disposal Methods: DISSOLVE OR MIX MATL W/COMBUST SOLVENT & BURN IN CHEMICAL INCINERATOR EQUIPPED WITH AN AFTERBURNER AND SCRUBBER. OBSERVE ALL FEDERAL, STATE AND LOCAL ENVIRONMENTAL REGULATIONS.

Handling And Storage Precautions: HARMFUL. HARMFUL IF SWALLOWED. IRRITATING TO EYES, RESP SYS & SKIN. POSS RISK OF IRREVERSIBLE EFTS. POSSIBLE MUTAGEN. PHOTSENSITIZER.

Other Precautions: WEAR SUITABLE PROT CLTHG. DO NOT BREATHE DUST. AVOID INHALATION. DO NOT GET IN EYES, ON SKIN, ON CLTHG. AVOID PRLNGD/RPTD EXPOSURE. HARMFUL SOLID. IRRITANT. KEEP TIGHTLY CLOSED. STORE IN COOL DRY PLAC E.

Fire and Explosion Hazard Information

=====

Extinguishing Media: WATER SPRAY. CARBON DIOXIDE, DRY CHEMICAL POWDER OR APPROPRIATE FOAM.

Fire Fighting Procedures: USE NIOSH APPROVED SCBA & FULL PROTECTIVE EQUIPMENT (FP N).

Unusual Fire/Explosion Hazard: EMITS TOXIC FUMES UNDER FIRE CONDITONS.

Control Measures

=====

Respiratory Protection: NIOSH APPROVED RESPIRATOR.

Ventilation: MECHANICAL EXHAUST REQUIRED.

Protective Gloves: RUBBER GLOVES.

Eye Protection: ANSI APPRVD CHEM WORKERS GOGGLES (FP N).

Other Protective Equipment: ANSI APPRVD EYE WASH & DELUGE SHOWER (FP N).

Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.

Supplemental Safety and Health: EFTS OF OVEREXP: REGISTRY OF TOX EFTS OF CHEM SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFO.

Physical/Chemical Properties

=====

B.P. Text: 637F, 336C

M.P/F.P Text: >210F, >99C

Spec Gravity: 1.063

Evaporation Rate & Reference: NOT KNOWN

Solubility in Water: NOT KNOWN

Appearance and Odor: WHITE TO OFF-WHITE CRYSTALS.

Reactivity Data

=====

Stability Indicator: YES

Stability Condition To Avoid: NONE SPECIFIED BY MANUFACTURER.

Materials To Avoid: STRONG OXIDIZING AGENTS.

Hazardous Decomposition Products: TOXIC FUMES OF: CARBON MONOXIDE, CARBON DIOXIDE.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: NOT RELEVANT.

Toxicological Information

Ecological Information

MSDS Transport Information

Regulatory Information

Other Information

HAZCOM Label

Product ID: PHENANTHRENE 98%, P1140-9

Cage: 60928

Company Name: ALDRICH CHEMICAL CO INC

Street: 1001 WEST ST PAUL AVE

PO Box: 355

City: MILWAUKEE WI

Zipcode: 53233

Health Emergency Phone: 414-273-3850

Label Required IND: Y

Date Of Label Review: 02/24/1998

Status Code: C

Label Date: 02/24/1998

Origination Code: G

Chronic Hazard IND: Y

Eye Protection IND: YES

Skin Protection IND: YES

Signal Word: WARNING

Respiratory Protection IND: YES

Health Hazard: Moderate

Contact Hazard: Moderate

Fire Hazard: None

Reactivity Hazard: None

Hazard And Precautions: ACUTE: HARMFUL IF SWALLOWED. MAY BE HARMFUL IF INHALED. MAY BE HARMFUL IF ABSORBED THRU SKIN. CAUSES EYE & SKIN IRRIT. MATL IS IRRITATING TO MUC MEMBRANES & UPPER RESP TRACT. CAUSES PHOTSENSITIVITY. EXPOS TO LIGHT CAN RSLT IN ALLERGIC REACTIONS RESULTING IN DERMATOLOGIC LESIONS, WHICH CAN VARY FROM SUNBURNLIKE RESPONSES TO EDEMATOUS, VESICULATED LESIONS OR BULLAE. CHRONIC: LABORATORY EXPERIMENTS HAVE SHOWN MUTAGENIC EFFECTS. CAN CAUSE SKIN PHOTSENSITIZATION AND ALLERGIC REACTIONS.

Disclaimer (provided with this information by the compiling agencies): This information is formulated for use by elements of the Department of Defense. The United States of America in no manner whatsoever expressly or implied warrants, states, or intends said information to have any application, use or viability by or to any person or persons outside the Department of Defense nor any person or persons contracting with any instrumentality of the United States of America and disclaims all liability for such use. Any person utilizing this instruction who is not a military or civilian employee of the United States of America should seek competent professional advice to verify and assume responsibility for the suitability of this information to their particular situation regardless of similarity to a corresponding Department of Defense or other government situation.

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11/18/2002

ALDRICH CHEMICAL INC -- PHENANTHRENE 98%, P1140-9

MSDS Safety Information

FSC: 6810

MSDS Date: 05/28/1997

MSDS Num: CGNRV

LTIN: 00N014546

Product ID: PHENANTHRENE 98%, P1140-9

MFN: 02

Responsible Party

Cage: 60928

Name: ALDRICH CHEMICAL CO INC

Box: 355

City: MILWAUKEE MI 52301

Info Phone Number: 414-273-3850

Emergency Phone Number: 414-273-3850

Published: Y

Contractor Summary

Cage: 60928

Name: ALDRICH CHEMICAL CO INC

Address: 1001 WEST ST PAUL AVE

Box: 355

City: MILWAUKEE WI 53233

Phone: 414-273-3850

Ingredients

Cas: 85-01-8

RTECS #: SF7175000

Name: PHENANTHRENE (CERCLA)

OSHA PEL: N/K (FP N)

ACGIH TLV: N/K (FP N)

EPA Rpt Qty: 5000 LBS

DOT Rpt Qty: 5000 LBS

Health Hazards Data

LD50 LC50 Mixture: NONE SPECIFIED BY MANUFACTURER.

Route Of Entry Inds - Inhalation: YES

Skin: YES

Ingestion: YES

Carcinogenicity Inds - NTP: NO

IARC: NO

OSHA: NO

Effects of Exposure: ACUTE: HARMFUL IF SWALLOWED. MAY BE HARMFUL IF INHALED, MAY BE HARMFUL IF ABSORBED THRU SKIN. CAUSES EYE & SKIN IRRIT. MATL IS IRRITATING TO MUC MEMBRANES & UPPER RESP TRACT. CAUSES PHOTSENSITIVITY. EXPOS TO LIGHT CAN RSLT IN ALLERGIC REACTIONS RESULTING IN DERMATOLOGIC LESIONS, WHICH CAN VARY FROM (EFTS OF OVEREXP)

Explanation Of Carcinogenicity: NOT RELEVANT.

Signs And Symptoms Of Overexposure: HLTH HAZ: SUNBURNLIKE RESPONSES TO EDEMATOUS, VESTICULATED LESIONS/BULLAE. CHRONIC: LAB EXPERIMENTS HAVE SHOWN MUTAGENIC EFTS. ADDNL INFO: CAN CAUSE SKIN PHOTSENSITIZATION. TARGET ORGAN DATA: SKIN & APPENDAGES(TUMORS). TUMORIGENIC: (NEOPLASTIC BY RTECS CRITERIA) (TUMORS AT SITE OF APPLIC). ONLY SELECTED (SUPDAT)

Medical Cond Aggravated By Exposure: NONE SPECIFIED BY MANUFACTURER.

First Aid: EYES: IMMEDIATELY FLUSH WITH COPIOUS AMTS OF WATER FOR AT LST 15 MINUTES. SKIN: IMMEDIATELY WASH WITH SOAP & COPIOUS AMTS OF WATER. INHAL: REMOVE TO FRESH AIR. IF NOT BREATHING GIVE ARTF RESP. IF BREA THING IS DIFFICULT, GIVE OXYGEN. INGEST: WASH OUT MOUTH WITH WATER PROVIDED PERSON IS CONSCIOUS. CALL PHYS. DISCARD CONTAMINATED CLOTHING AND SHOES.

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Control Measures

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Ventilation: MECHANICAL EXHAUST REQUIRED.

Protective Gloves: RUBBER GLOVES.

Eye Protection: ANSI APPRVD CHEM WORKERS GOGGLES (FP N).

Other Protective Equipment: ANSI APPRVD EYE WASH & DELUGE SHOWER (FP N).

Work Hygienic Practices: WASH THOROUGHLY AFTER HANDLING.

Supplemental Safety and Health: EFTS OF OVEREXP: REGISTRY OF TOX EFTS OF CHEM SUBSTANCES (RTECS) DATA IS PRESENTED HERE. SEE ACTUAL ENTRY IN RTECS FOR COMPLETE INFO.

Physical/Chemical Properties

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Reactivity Data

=====

Stability Indicator: YES

Stability Condition To Avoid: NONE SPECIFIED BY MANUFACTURER.

Materials To Avoid: STRONG OXIDIZING AGENTS.

Hazardous Decomposition Products: TOXIC FUMES OF: CARBON MONOXIDE, CARBON DIOXIDE.

Hazardous Polymerization Indicator: NO

Conditions To Avoid Polymerization: NOT RELEVANT.

Toxicological Information

Ecological Information

MSDS Transport Information

Regulatory Information

Other Information

HAZCOM Label

Product ID: PHENANTHRENE 98%, P1140-9

Cage: 60928

Company Name: ALDRICH CHEMICAL CO INC

Street: 1001 WEST ST PAUL AVE

PO Box: 355

City: MILWAUKEE WI

Zipcode: 53233

Health Emergency Phone: 414-273-3850

Label Required IND: Y

Date Of Label Review: 02/24/1998

Status Code: C

Label Date: 02/24/1998

Origination Code: G

Chronic Hazard IND: Y

Eye Protection IND: YES

Skin Protection IND: YES

Signal Word: WARNING

Respiratory Protection IND: YES

Health Hazard: Moderate

Contact Hazard: Moderate

Fire Hazard: None

Reactivity Hazard: None

Hazard And Precautions: ACUTE: HARMFUL IF SWALLOWED. MAY BE HARMFUL IF INHALED. MAY BE HARMFUL IF ABSORBED THRU SKIN. CAUSES EYE & SKIN IRRIT. MATL IS IRRITATING TO MUC MEMBRANES & UPPER RESP TRACT. CAUSES PHOTSENSITIVITY. EXPOS TO LIGHT CAN RSLT IN ALLERGIC REACTIONS RESULTING IN DERMATOLOGIC LESIONS, WHICH CAN VARY FROM SUNBURNLIKE RESPONSES TO EDEMATOUS, VESICULATED LESIONS OR BULLAE. CHRONIC: LABORATORY EXPERIMENTS HAVE SHOWN MUTAGENIC EFFECTS. CAN CAUSE SKIN PHOTSENSITIZATION AND ALLERGIC REACTIONS.

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